Calcasieu Estuary Remedial Investigation/Feasibility Study (RI/FS): Baseline Ecological Risk Assessment (BERA)

Appendix G: Deterministic Ecological Risk Assessment for Aquatic and Wildlife Receptors

Prepared For:

CDM Federal Programs Corporation
8140 Walnut Hill Lane, Suite 1000
Dallas, Texas 75231

Under Contract To:

Mr. John Meyer, Regional Project Manager
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Prepared – October 2002 – By:

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Under Contract To:

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#24 - 4800 Island Highway North
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Appendix G. Deterministic Ecological Risk Assessment for Aquatic and Wildlife Receptors

1.0   Background

In response to the concern over environmental contamination in the Calcasieu Estuary, a Remedial Investigation/Feasibility Study (RI/FS) is being conducted in the Estuary.   One of the objectives of the RI/FS is to determine the risks posed by environmental contamination to ecological receptors inhabiting the Calcasieu Estuary. To meet this objective a Baseline Ecological Risk Assessment (BERA) is required in accordance with the procedures laid out by the USEPA in the *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessment* (USEPA 1997).   Under the eight-step process described by the USEPA for conducting a BERA, a screening ecological risk assessment (SERA) must be conducted to determine preliminary estimates of exposure and risk.

In 1999, CDM Federal Programs Corporation conducted a SERA for the Calcasieu Estuary, which concluded that there was a potential risk to ecological receptors inhabiting the Estuary from exposure to contaminated sediment and surface water (CDM 1999).   In September 2001, a Baseline Problem Formulation (BPF) was prepared that refined the preliminary list of chemicals, ecological effects, exposure pathways, fate and transport from the SERA (MacDonald *et al.* 2001).   The BPF also led to the development of assessment and measurement endpoints, a conceptual model, and a risk analysis plan. The objective of the BPF was to define the issues that needed to be addressed in the BERA for the Calcasieu Estuary.

One of the important conclusions of the BPF was that wildlife and fish inhabiting the Estuary may be exposed to substances of concern that are bioaccumulative via the

food web and direct ingestion of contaminated media (e.g., sediment). Several bioaccumulative substances were nominated as chemicals of potential concern (COPCs) in the BPF including mercury, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), polychlorinated dibenzo-*p*-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), hexachlorobenzene (HCB), hexachlorobutadiene (HCBD), aldrin, and dieldrin (see Table A1-7 in BPF).

In the spring of 2001, fish and invertebrate whole body tissue samples were obtained from areas of concern (AOC) and reference areas in the Calcasieu Estuary according to a Phase II sampling program (CDM 2000). These samples were obtained to provide tissue residue data for the baseline ecological risk assessment for wildlife and predatory fish in the Estuary. The tissues were analyzed for a broad suite of organic and inorganic chemicals, including PCB and PCDD/PCDF congeners.

1.1 Purpose and Objectives of this Appendix

To date, the ecological assessment work conducted for the Calcasieu Estuary has not characterized the potential for risks to wildlife and predatory fish from exposure to COPCs via the food chain. The BPF indicates that many bioaccumulative substances pose a potential risk to wildlife and predatory fish from dietary exposures. The purpose of this appendix is to develop conservative, deterministic estimates of risk for focal wildlife and fish receptors potentially exposed to COPCs identified in the BPF. These screening estimates are used to identify those COPCs (referred to as contaminants of concern or COCs) that will be subjected to a more detailed ecological risk assessment for wildlife and fish species employing probabilistic techniques. To provide this screening information, three objectives must be met:

- The identification of COCs that pose a potential risk to wildlife and/or carnivorous fish species;
- The identification of wildlife and carnivorous fish species potentially at risk from each COC; and,
- The identification of areas within the Estuary that are of potential concern to wildlife and/or carnivorous fish for each COC.

1.2 Boundaries of Deterministic Risk Assessment

As with any risk assessment, there are boundaries, assumptions, and extrapolations used in the analysis that influence how the results should be interpreted and used. These items are listed below.

- A conservative assessment approach was used. This means that upper or lower bound values (5th or 95th percentiles) were used in exposure and effects analyses, accordingly, to give a conservative result;
- The deterministic risk assessment used single conservative point estimates for model variables rather than information from the entire statistical distribution of individual variables;
- Readily available exposure parameter values and wildlife benchmarks from the published literature were used (e.g., USEPA 1993; Sample *et al.* 1996; Jarvinen and Ankley 1998);
- As the purpose of this assessment is to provide the basis for determining which COCs should undergo a more detailed probabilistic risk assessment, no detailed elaboration on the environmental significance of positive risk quotients in the risk characterization section was undertaken; and,

- The deterministic risk assessment does not include quantitative analyses of uncertainty. This will be addressed in the probabilistic risk assessment for those contaminants of concern (COCs) that screen through.

2.0   Conceptual Model

Sources and releases of COPCs, their environmental fate, potential exposure pathways for wildlife and carnivorous fish, identification of species potentially at risk, and risk hypotheses for COPCs have been described for the Calcasieu Estuary in Chapter 7 of the baseline problem formulation. The conceptual site model for wildlife and carnivorous fish exposures to COPCs from food chain pathways described in the BPF was adopted for use in the current assessment.

3.0   Areas of Concern in the Calcasieu Estuary

The areas of concern for this assessment are those areas identified in Chapter 2 of the BPF and they include:

- Upper Calcasieu River AOC (UCR AOC);
- Bayou d'Inde AOC (BI AOC);
- Middle Calcasieu River AOC (MCR AOC);
- Sabine National Wildlife Refuge; and
- Other Reference Areas.

The areas of concern were sampled for fish and invertebrates in the Phase II sampling program. Each of the AOCs are divided into sub-areas that described below.

The sub-areas of Bayou d'Inde AOC sampled for fish and invertebrates included:

- Upper Bayou d'Inde;
- Middle Bayou d'Inde; and,
- Lower Bayou d'Inde.

The sub-areas of the Upper Calcasieu River AOC sampled for fish and invertebrates included:

- Coon Island Northeast;
- Coon Island Southwest;
- Clooney Island Loop; and,
- Lake Charles.

The sub-areas of the Middle Calcasieu River AOC sampled for fish and invertebrates included:

- Prien Lake;
- Citgo Surge Pond;
- Old River Channel;
- Indian Marias Lagoon; and,
- Moss Lake.

The sub-areas of the Reference Areas sampled for fish and invertebrates included:

- Bayou Connine Bois;
- Choupique Bayou;
- Grand Bayou and Wetlands;
- Johnson's Bayou;
- Calcasieu Lake; and,
- Sabine National Wildlife Refuge (sediment and sediment invertebrate data only).

Analysis of the data for the deterministic risk assessment was performed at the level of the area of concern rather than sub-area for simplicity and to ensure adequate sample size.

4.0 Chemicals of Potential Concern for the Deterministic Risk Assessment

The COPCs identified in the BPF (Table A1-7) that have the potential to bioaccumulate in the food chain of wildlife and carnivorous fish inhabiting the Calcasieu Estuary were used to develop an initial list of COPCs for the deterministic risk assessment. These substances included:

- Mercury;
- PAHs [high molecular weight (HMW), low molecular weight (LMW), total PAHs];
- PCBs (Aroclors, congeners, total PCBs);

- PCDD/PCDFs;
- Chlorinated benzenes; and,
- Organochlorine pesticides (e.g., aldrin, dieldrin).

In addition, those substances that appeared to have elevated concentrations in the tissues of fish, sediment invertebrates, or sediment from the areas of concern, and had a relatively high measured or predicted BCF or BAF (as reported in Sample *et al.* 1996) and/or a wildlife benchmark value in Sample *et al.* (1996) showing test species no observed adverse effect level (NOAEL) or lowest observed adverse effect level (LOAEL) in the low or sub mg/kg bw/day range, were also added for further investigation in this assessment. This resulted in the addition of the following substances for deterministic assessment:

- Cadmium;
- Bis(2-ethylhexyl)phthalate (BEHP);
- DDT and metabolites;
- Isomers of HCH (alpha, beta, delta);
- Lead;
- Lindane (gamma-HCH);
- Di-n-butylphthalate (DNBP); and,
- Selenium.

4.1 2,3,7,8-TCDD Toxic Equivalents

A total of 11 PCB congeners, seven PCDD congeners, and ten PCDF congeners with a common mode of action on the aryl-hydrocarbon receptor were analyzed in this assessment using the toxic equivalent (TEQ) approach described by van den Berg *et al.* (1998). Bird, mammal, and fish TEQs were developed based on the list of

congeners presented in van den Berg *et al.* (1998) according to the following equation and using the toxic equivalency factors (TEFs) in Table G-1. PCB-123 was not included in the list of congeners as no tissue or sediment data were available for this congener. Therefore the TEQ value is comprised of only 28 congeners.

$$TEQ = \sum_{n=1}^{7} [PCDD_n \ x \ TEF_n] + \sum_{p=1}^{10} [PCDF_p \ x \ TEF_p] + \sum_{q=1}^{11} [PCB_q \ x \ TEF_q] \quad \textbf{(1)}$$

where:

TEQ	=	Toxic equivalent (relative to 2,3,7,8-TCDD);
PCDD$_n$	=	Polychlorinated dibenzo-*p*-dioxin congener concentration;
PCDF$_p$	=	Polychlorinated dibenzo-*p*-furan congener concentration;
PCB$_q$	=	Polychlorinated biphenyl congener concentration;
TEF$_{n,p,q}$	=	Toxic equivalency factor for appropriate individual PCDD, PCDF, and PCB congeners, respectively.

5.0   Focal Wildlife and Carnivorous Fish Species

The Calcasieu Estuary contains a variety of wildlife and fish species that inhabit both terrestrial and aquatic environments. The identification of potential receptors at risk in the areas of concern has previously been undertaken in the BPF. Focal wildlife and fish species exposed to COPCs via the food chain were identified in the BPF for birds, mammals, and carnivorous fish. These species were used for this conservative, deterministic risk assessment. In the BPF, foraging behavior was used to classify the species into guilds for exposure analysis. Table G-2 identifies the guilds and the corresponding focal species used for this assessment. A more detailed description of

the feeding habits of the focal species and their prey can be found in Appendix 18 in the BPF and Phase II sampling program report (CDM 2000).

6.0 Assessment and Measurement Endpoints for the Deterministic Risk Assessment

The assessment endpoints for the Calcasieu Estuary BERA were identified in the BPF. Table A1-13 in the BPF summarizes the candidate assessment and measurement endpoints for bioaccumulative substances for all guilds and focal species used in this deterministic assessment. Table A1-14 in the BPF identifies additional candidate assessment and measurement endpoints for substances that partition into sediments. Sediment-probing birds are included in this table because their major exposure pathways are via incidental ingestion of sediment-dwelling prey items and, to a lesser degree, sediment. Assessment endpoints for all focal species in this assessment are generally concerned with effects on survival, growth, or reproduction. Measurement endpoints are generally levels in tissues or doses causing lethal and sub-lethal effects.

7.0 Data Quality Issues and Manipulation

There were a number of data quality issues that affected the SERA and subsequent analyses in the BERA, including this appendix. These issues are outlined below.

Tissue data for the each identified COPC were screened prior to use in any analysis. Some of the tissue data did not meet the data quality objectives (DQOs) for the

project. In particular, many samples had reported non-detect results that were orders of magnitude higher than the common range of method detection limits (MDL) for the particular analytical method used. In general, this was the result of two issues.

1. **Sample Dilution** - If a COPC was detected in a tissue sample, but could not be quantified because the concentration was too high, the sample was diluted. Depending on the dilution factor chosen (e.g., 10X, 100X), the MDL was subsequently increased by the dilution factor. If the wrong dilution factor was chosen, the MDL would then be above the tissue concentration resulting in a non-detect being reported. Proper laboratory practice requires that the sample be re-tested with a reduced dilution factor until a quantifiable result above the MDL is found. A detect flag other than non-detect would then be assigned to the sample result. Proper laboratory practice was not applied in this case resulting in inappropriate MDLs. Use of half the method detection limit in subsequent risk assessments would result in highly inaccurate hazard quotients or risk estimates.

2. **Interference** - Highly chlorinated compounds can interfere with the analysis of other chlorinated compounds unless appropriate clean-up procedures are used to address them. In this project, tissue samples were analyzed for a variety of chlorinated compounds including PCBs, PCDD/PCDF, HCH-isomers, hexachlorobenzene, hexachlorobutadiene, etc. If interference occurred in the tissue sample results for chlorinated compounds, the end result would be values that may not have been quantifiable without an appropriate dilution. This would again result in a non-detect result with a very high MDL.

Both of these factors can impact the screening risk assessment and subsequent probabilistic risk assessment. Because non-detect data are generally treated as ½ the detection limit in risk calculations, extremely high MDL values may cause inaccurate results. To address this issue tissue residue benchmarks (*i.e.*, USEPA 1993; Sample *et al.* 1996; Jarvinen and Ankley 1998) were used to screen out samples with non-detect results higher than the benchmark. If no tissue residue benchmark was available for a particular COPC, then professional judgement was used to remove those outlier samples with high MDLs that were non-detects.

An additional data screen was performed to address the high numbers of non-detect results in the database for all COPCs. This screen examined the contribution of non-detect data to the number of results for each COPC. If the non-detect values comprised greater than 90% of the total number of results, the COPC was removed from further analysis in the deterministic assessment for wildlife and subsequently in the probabilistic risk assessment (PRA). The purpose of this screen is to remove the possibility that non-detect values could completely drive the inclusion of the COPC in the PRA and the subsequent risk analysis. The results for bis(2-ethylhexyl) phthalate, aldrin, dieldren, DDT and metabolites (i.e., DDD and DDE), and di-n-butylphthalate in biota were primarily non-detect values (>90% non-detects). This does not necessarily mean that these COPCs do not pose a risk to biota in the Estuary. Rather, we simply do not have the ability, considering the data available, to evaluate the risk of these COPCs to biota in the areas of concern.

Historically, total PCBs have been reported as the sum of the Aroclor values (Newman *et al*. 1998; Sather *et al*. 2001) where Aroclor determination is based on comparison to an Aroclor standard. This was previously due to an inability to discern individual congeners. The analytical determination of Aroclors does not take into account physiological, spatial nor temporal changes (e.g., environmental weathering;

congener metabolism) in the Aroclor mixtures. These processes can modify mixture toxicity (Newman *et al*. 1998; Sather *et al*. 2001). The preferred analytical method for determination of total PCBs is to sum the PCB congeners (Boon *et al.* 1997; McFarland and Clarke 1989; Newman *et al*. 1998; Sather *et al*. 2001). This method accounts for the weathering and metabolic processes that can modify toxicity and is particularly relevant to concentrations in higher trophic level organisms (Boon *et al*. 1997; Sather *et al*. 2001). Congener-specific methods avoid the need to determine which Aroclor profile most closely fits the detected congener profile in biota or media samples, and does not require assumptions to be made about congener metabolism and weathering. Roughly 20% of the media and biota samples from the Calcasieu Estuary sampling programs (i.e., Phase I and Phase II) were analyzed for PCB congeners. In whole body fish and aquatic invertebrates, only 23 PCB congeners were reported. Although not all 209 PCB congeners are required for total PCB determination, McFarland and Clarke (1989) recommended the inclusion of 36 PCB congeners considered the most relevant to environmental samples. The second preferred method of total PCB determination is to sum the PCB homologs detected in the sample. The different arrangements of congeners are categorized into subgroups called homologs. Each homolog contains congeners with the same number of chlorine atoms (MacDonald *et al*. 2001). By summing the homologs, metabolic and weathering processes are taken into account and no determination is required regarding the appropriate Aroclor profile. To determine the PCB homologs, congener analysis is required. As only a small subset of congeners (~23) was reported in the Calcasieu samples, this method could not be used to determine total PCB concentrations.

A review of the analytical results from the biota samples collected in Phase II of the Calcasieu sampling program revealed that Aroclor 1016, Aroclor 1221, Aroclor 1232, and Aroclor 1242 were not detected in any aquatic invertebrate and whole body fish

samples collected from the AOCs. Because non-detect values can contribute significantly to the total PCB concentration, if half of the detection limit is used for non-detects, these Aroclors were excluded from the total PCB calculation here and in the subsequent PRA appendices. Aroclor 1254 and Aroclor 1260 were detected in tissue samples in all AOCs. Aroclor 1254 contains 54% chlorine compared to 60% chlorine in Aroclor 1260. These two Aroclors have very similar congener compositions and as such the analytical resolution of mixtures containing these two Aroclors overlaps (i.e., the same congeners are present in both Aroclors). To account for this overlap, results for each Aroclor were compared on a sample-by-sample basis, and the Aroclor with the highest result or method detection limit was used as an estimate of the total PCB concentration in the sample in the conservative, deterministic risk assessment and the subsequent PRAs (i.e., Appendices F2, H, and I).

Toxic equivalents (TEQs) were generated for tissue samples in which PCB, PCDD, and PCDF congeners were analyzed. There are two issues that arise with the generation of TEQs using the Calcasieu Estuary data.

1. PCB congener 123 (PCB 123) was missing from the analytical results for tissue. PCB 123 is one of the 29 TEQ congeners identified by van den Berg *et al.* (1998) in the World Health Organization (WHO) TEQ scheme (see Table G-1). The toxic equivalency factors for PCB-123 are 0.0001, <0.000005, and 0.00001 for mammals, fish and birds, respectively. These TEF values are low relative to many of the other congeners. Therefore, although the TEQ will be slightly underestimated, the calculated TEQs using the remaining PCB and PCDD/PCDF congeners should be considered acceptable.

2. There were large numbers of non-detect values for many of the 28 TEQ congeners. As a conservative assumption, ½ the sample detection limit was used to estimate the concentration of the congener in non-detected tissue samples. If the non-detected congeners contributed greater than 25% of the TEQ value, the TEQ was not calculated for that tissue sample. The purpose of this QA step is to avoid having hazard quotients calculated for TEQs where non-detects are driving the TEQ estimate.

7.1 Historical Tissue Data

Levels of Aroclor 1254 in tissues of fish collected from CH2M Hill's Calcasieu Estuary Biological Monitoring Program were consistent with levels found in the Phase II Sampling Program. Levels in whole body determined in 2001 during Phase II Sampling and levels in fillet recorded since 1991 by CH2M Hill were used for statistical analysis. For comparison, fillet concentrations were estimated for the samples collected from the Phase II Sampling Program using the following equation:

$$C_f = C_{wb} / 2.3 \qquad\qquad (2)$$

where, C_{wb} is whole-body concentration and C_f is fillet concentration (SAIC 1993).

Annual geometric mean concentrations in fillet of red drum, black drum, spotted seatrout, sand seatrout and southern flounder were calculated for the four AOCs. The geometric mean concentration of Aroclor 1254 in fillet collected from the Upper Calcasieu River AOC during the Phase II Sampling Program was 0.013 mg/kg, with minimum and maximum concentrations of 0.002 mg/kg and 0.478 mg/kg, respectively. Since 1991, the annual geometric mean concentrations determined by CH2M Hill's Biological Monitoring Program ranged from 0.006 mg/kg to 0.040

mg/kg and the minimum and maximum concentrations were 0.005 mg/kg and 0.232 mg/kg, respectively (Figure G-1).

The geometric mean concentration of Aroclor 1254 in fillet collected from the Bayou d'Inde AOC during the Phase II Sampling Program was 0.016 mg/kg, with minimum and maximum concentrations of 0.002 mg/kg and 0.230 mg/kg, respectively. Since 1991, the annual geometric mean concentrations determined by CH2M Hill's Biological Monitoring Program ranged from 0.028 mg/kg to 0.133 mg/kg and the minimum and maximum concentrations were 0.003 mg/kg and 1.080 mg/kg, respectively (Figure G-2).

The geometric mean concentration of Aroclor 1254 in fillet collected from the Middle Calcasieu River AOC during the Phase II Sampling Program was 0.013 mg/kg, with minimum and maximum concentrations of 0.002 mg/kg and 0.317 mg/kg, respectively. Since 1991, the annual geometric mean concentrations determined by CH2M Hill's Biological Monitoring Program ranged from 0.008 mg/kg to 0.031 mg/kg and the minimum and maximum concentrations were 0.003 mg/kg and 0.221 mg/kg, respectively (Figure G-3).

The geometric mean concentration of Aroclor 1254 in fillet collected from the Calcasieu Estuary reference areas during the Phase II Sampling Program was 0.006 mg/kg, with minimum and maximum concentrations of 0.002 mg/kg and 0.029 mg/kg, respectively. Since 1991, the annual geometric mean concentrations determined by CH2M Hill's Biological Monitoring Program ranged from 0.006 mg/kg to 0.016 mg/kg and the minimum and maximum concentrations were 0.003 mg/kg and 0.378 mg/kg, respectively (Figure G-4).

The comparison of historical data sets between the Phase II Sampling Program and CH2M Hill's Biological Monitoring Program showed that there was less than one order of magnitude difference in levels of total PCBs in fish tissue between the ten years of historical data and data collected in the Phase II Sampling Program. In most cases, the difference was less than four fold. This demonstrates that the results of the deterministic ecological risk assessment wildlife using data from the Phase II Sampling Program are likely to be temporally representative.

8.0 Exposure Models

8.1 Wildlife

The general exposure model described in the baseline problem formulation and used in this conservative, deterministic risk assessment for wildlife is:

$$TDI = \left[FMR\left(\frac{C_i \cdot P_i}{GE_i \cdot AE_i} \right) + \left(C_s \cdot IR_s \right) \right] \cdot Pt \qquad \textbf{(3)}$$

where:

TDI =   Total daily intake (mg/kg bw/day);

FMR =   Normalized free metabolic rate of foraging guild of interest (kcal/kg bw/day);

C_i =   Concentration of contaminant in the *i*th prey species (mg/kg ww);

P_i = Proportion of the ith prey species in the diet (unitless);

GE_i = Gross energy of the ith prey species (kcal/kg prey);

AE_i = Assimilation efficiency of the ith prey species by the wildlife receptor of interest;

C_s = Concentration of contaminant in the sediments (mg/kg dw);

IR_s = Intake rate of sediments (kg dw/kg bw/day);

Pt = Proportion of time spent in the contaminated portion of the area of interest (unitless).

The general exposure model calculates a total daily intake (TDI) associated with the ingestion of contaminated prey and environmental media (e.g., sediments). Tables G-3 to G-7 show the TDIs calculated for each foraging guild for all COPCs in this study as well as the values of individual exposure model variables used in the calculations.

A description and definition of each variable in the above equation is given in the BPF. The following sections, therefore, outline how the values for each variable were calculated for this assessment. Experimental values were preferred over estimated values, such as those derived using allometric equations.

Body Weight (BW)

Although not used in the exposure model directly, body weight is required to estimate free metabolic rate (*FMR*) when a measured *FMR* is not available for a focal species. Body weight is also used to determine food ingestion rates needed to calculate sediment ingestion rates (*IR_s*). Body weight data for focal species were gathered from USEPA (1993) and Dunning (1984).

Normalized Free Metabolic Rate (FMR)

Measured free metabolic rates for focal species reported in USEPA (1993) were used when available. The upper of the reported range or the 95% upper confidence limit *FMR* was used when reported. When measured *FMRs* were not available, they were estimated using the allometric relationship of Nagy (1987) for the species in question. The following relationships were used.

For non-passerines:

$$FMR = 1.46BW^{0.749} \qquad\qquad (4)$$

For seabirds (pelicans, terns):

$$FMR = 1.916BW^{0.704} \qquad\qquad (5)$$

For mammals:

$$FMR = 0.62BW^{0.862} \qquad\qquad (6)$$

Where, *FMR* is the free or field metabolic rate in kcal/day and *BW* is body weight in grams. *FMRs* were estimated using the 95% upper confidence limit of the reported body weights. The 5% lower confidence limit was used to normalize to body weight of the focal species to produce an overall conservative result.

Concentration of Chemicals in the ith Prey Species (C_i) and Sediment (C_s)

The data for all COPCs in the tissues of fish and invertebrates were organized according to prey group (see below) within each area of concern. Sediment data and sediment-dwelling invertebrate (e.g., *Nereis virens,* shrimp) data were organized by area of concern. The 95th percentile of a fitted lognormal distribution was used for calculations of exposure. Data for *Nereis virens* were obtained from 28-day

bioaccumulation studies with sediments from the areas of concern. Where possible, data for benthic invertebrates (e.g., shrimp, crabs) other than *Nereis virens* were used. Due to the short exposure period (28-days) of the worms, it is unclear whether equilibrium would have been achieved in the laboratory tests. However, if only *Nereis virens* data were available for a particular AOC, they were used as surrogates. Values for non-detects were assumed to be equal to half the detection limit in this assessment.

Proportion of the ith Prey Species in the Diet (P_i)

Fish and benthic invertebrates were considered the primary prey items for the wildlife species examined. The proportion of a prey item in the diet varies according to the focal species of interest, and prey items were organized into four groups representing size, distribution in the water column, trophic level, and foraging range. For carnivorous and piscivorus birds, the diet was assumed to be comprised of 100% group 1 and 2 fish and piscivorus mammals had a diet of 50% group 1 and 50% group 4 fish. For omnivorous mammals, 100% of the diet was assumed to consist of Group 1 fish. This approach is conservative because the diet of omnivorous mammals consists of many food items including invertebrates, plants, insects, and other mammals that may be terrestrial. These prey items are likely to have lower concentration of the COPCs. Benthic invertebrates (i.e., crabs and shrimp) were used as representative prey for sediment-probing birds.

Gross Energy of the ith Prey Species (GE_i)

The gross energies of prey species used in the exposure model were obtained from reported values in USEPA (1993). The 5% lower confidence limit of gross energy values were used when mean and standard deviation data were reported. Otherwise the single reported value was used.

Assimilation Efficiency of the ith Prey Species (AE_i)

The assimilation efficiency of fish by each focal species was obtained from reported values in USEPA (1993). The 5% lower confidence limit AE_i was used when mean and standard deviation data were reported. Otherwise the single reported value was used.

Intake Rate of Sediments (IR_s)

The daily intake rate of sediment (dry weight) normalized to body weight of the receptor was estimated using the wildlife oral dose equation for soil or sediment ingestion exposures as described in USEPA (1993). The following equation was used:

$$IR_s = F_S \bullet IR_f / BW \tag{7}$$

where:

IR_s = Intake rate of sediments (kg/bw day dw);

F_S = Fraction of sediment in the diet of the focal species (i.e., sediment-probing bird; unitless);

IR_f = Food intake rate (kg/day dw);

BW = Body weight of the focal species (kg).

The F_S value of 30% for the spotted sandpiper using the semi-palmated sandpiper as a surrogate species and an F_S of 2% for lesser scaup based on ring-necked duck as surrogate species were obtained from USEPA (1993). F_S values of 3% for Willet (Beyer et al. 1999) and 2% for black-necked stilt (USEPA 1993) were used as a default because no values could easily be obtained from the literature. IR_f values were calculated using the allometric equations of Nagy (1987) as:

$$IR_f \text{(all birds)} = 0.0582 BW^{0.651} \tag{8}$$

All sediment ingestion rates were estimated. The 95% upper confidence limit of body weight was used to calculate the IR_f and the 5% lower confidence limit was used to normalize to body weight of the focal species to produce an overall conservative result.

Proportion of Time in Contaminated Area (P_t)

For the conservative, deterministic risk assessment of wildlife, the time spent foraging in the contaminated areas of the Calcasieu Estuary was set to 100%.

8.2 Carnivorous Fish

Estimates of total daily intake were not calculated for carnivorous fish because of the lack of toxicity studies using dietary exposures for the list of COPCs. These are needed to calculate fish dietary-based toxicity benchmarks (i.e., tolerable daily intakes) to compare to the total daily intakes. For this assessment, whole body burdens of each COPC in fish were used as a measures of the total exposure from all routes of exposure (e.g., prey ingestion, sediment ingestion, surface water contact). The fish whole body burdens for bioaccumulative substances will include, and largely be, a result of dietary uptake. The 95th percentile of the fish body residue distribution for black drum (*Pogonias cromis*) for each area was calculated and used for comparison to fish body residue toxicity benchmarks. The black drum was considered a conservative choice from the four focal species as it is: (1) the largest and most long-lived, therefore potentially acquiring larger COPC body burdens; and, (2) a high trophic level fish.

9.0   Effects Assessment

9.1   Wildlife

In this conservative, deterministic risk assessment, the characterization of effects relied on published toxicity reference values (TRVs) for birds and mammals from Sample *et al.* (1996). Both TRV-no observable adverse effect levels (NOAELs) and TRV-lowest observable adverse effects levels (LOAELs) reported in Sample *et al.* (1996) were used for effects characterization. The geometric mean of the body weight adjusted TRV_{NOAEL} and TRV_{LOAEL}, called the $TRV_{Chronic\ Value\ (ChV)}$, was derived where possible. The TRV_{ChV} was derived to give a median measure of potential effects in the NOAEL to LOAEL range. For mammals, each benchmark was adjusted to body weight according to the ratio of the body weight of the test animal and focal species. Wildlife benchmarks for birds were not further adjusted to body weight as no body weight relationship has been established for birds (Mineau *et al.* 1996). Piscivorus and omnivorous mammals were an exception to the practice of applying the Sample *et al.* (1996) benchmarks, for total PCBs only. A dose-response curve based on a meta-analysis of mink toxicity studies was readily available to generate a benchmark (Moore *et al.* 1999). Comparing the Sample *et al.* (1996) benchmark for total PCBs to the dose-response curve indicated that severe effects where expected to mink at the benchmark concentration. This is not consistent with the intended level of conservativism in the conservative, deterministic assessment. Therefore, the 20% effect dose from the dose-response curve, 0.0272 mg/kg bw/d, was divided by ten to derive the benchmark (0.00272 mg/kg bw/d). Table G-10 to G-14 list the TRVs used in this assessment according to COPC and wildlife species.

9.2 Carnivorous Fish

Tissue residue toxicity reference values for fish were taken from the comprehensive database of Jarvinen and Ankley (1998). Table G-9 lists the fish COPC TRVs. To maintain a conservative approach, the following guidelines were used for selection of fish tissue residue values (mg/kg) from the database.

- Only data generated from chronic exposures (>21 days) were used;
- Results with data quality issues in the comments field of the database were not selected;
- Only dietary exposures were considered;
- Whole body results were preferred over results for specific organs;
- When possible, data for a sensitive carnivorous fish species were used;
- The study with the lowest tissue residue value reporting a reduction in growth, reproduction, or lethality was selected to establish fish TRVs. This value was assumed to represent a LOAEL; and,
- If a no-effect value from the same study for the same endpoint as the LOAEL was available, it was selected and assumed to represent a NOAEL. If a no-effect value was not available, one was estimated by dividing the LOAEL by a safety factor of 10.

TRV_{ChV}s for fish were calculated when fish NOAELs and LOAELs were available. When a fish TRV for a COPC could not be estimated using the Jarvinen and Ankley (1999) database, one was calculated using a USEPA freshwater chronic criterion or acute marine criterion and multiplying this by a measured or estimated BCF to produce a fish TRV_{NOAEL}. Fish TRV_{NOAEL}s were estimated for aldrin, BEHP, and DNBP (Table G-9) using this method.

10.0 Risk Characterization

Risk quotients (RQs) were used to characterize risk in this conservative, deterministic assessment. TDIs for birds and mammals and whole body residues for fish were compared to TRVs. Because several COPCs had elevated levels in the reference areas, elevated RQs were sometimes observed in these areas as well. Consequently, the following decision rules were used to determine if a COPC screened through to the probabilistic risk assessment phase for a given COPC and AOC.

- If all RQs were less than 1.0 for all areas of concern for a COPC, the COPC was eliminated from further consideration;
- If RQs were $1.0 for at least one area of concern, but were less than 1.2 times the RQs for reference areas, the COPC was eliminated from further consideration. In these cases the COPC is unlikely to be causing significant incremental risk in the area of concern over what is occurring in the background; and,
- If RQs were $1.0 for at least one area of concern and were $1.2 times the RQ of the reference area, the COPC screened through to the next phase. Such chemicals are termed contaminants of concern (COCs).

The RQs calculated for all focal species for all areas and COPCs are presented in Tables G-9 to G-14, and summarized in Table G-15. Based on this conservative, deterministic assessment, the following COCs should proceed to the probabilistic risk assessment stage for wildlife:

- Mercury;
- Selenium;
- 2,3,7,8-TCDD-TEQs;
- Total PCBs; and,

- Lead.

The specific receptor, COC, and area combinations screening through to the PRA are listed in Tables G-16.

Discussion

All foraging guilds identified in the baseline problem formulation are considered potentially at risk from exposure to one or more COCs from the consumption of contaminated prey. More species are potentially at risk from exposure to mercury and TEQs than any other COC. Selenium was another contaminant that commonly screened through. The number of COCs screened through range from one for carnivorous fish to four for sediment-probing birds, piscivorus birds, and piscivorus mammals. Total PCBs (as measured by Aroclor 1254) was an important contaminant for piscivorus birds, piscivorus mammals, and carnivorous fish.

Bayou d'Inde AOC, Upper Calcasieu AOC, and Middle Calcasieu AOC all had levels of one or more COCs that posed a potential risk to wildlife and/or carnivorous fish from consumption of contaminated prey. More species are potentially at risk in the Bayou d'Inde AOC than in any other area of concern. The order of greatest risk potential for the AOCs is:

Bayou d'Inde AOC > Upper Calcasieu AOC > Middle Calcasieu AOC.

11.0 Conclusions

The results of this conservative deterministic wildlife and fish risk assessment showed that several foraging guilds are potentially at risk from exposure to organic and inorganic bioaccumulative and sorptive COCs in areas of the Calcasieu Estuary. This

assessment was conducted with a conservative methodology. Not all of these COCs, species, or areas are expected to be of concern after the complete distributions of exposure data are considered in the probabilistic phase of this assessment.

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Tables

**Table G-1. Toxic equivalency factors for fish, birds, and mammals as predators
(van den Berg *et al.* 1998).**

No.	Congener	TEF		
		Birds	**Fish**	**Mammals**
1	PCB-77	0.0001	0.05	0.0001
2	PCB-81	0.0005	0.1	0.0001
3	PCB-169	0.00005	0.001	0.1
4	PCB-105	< 0.000005[1]	0.0001	0.01
5	PCB-114	< 0.000005[1]	0.0001	0.0001
6	PCB-118	< 0.000005[1]	0.00001	0.0005
7	PCB-123	< 0.000005[1]	0.00001	0.0001
8	PCB-126	0.005	0.1	0.0001
9	PCB-156	< 0.000005[1]	0.0001	0.0001
10	PCB-157	< 0.000005[1]	0.0001	0.0005
11	PCB-167	< 0.000005[1]	0.00001	0.0005
12	PCB-189	< 0.000005[1]	0.00001	0.00001
13	1,2,3,4,6,7,8-HPCDD	0.001	< 0.001[1]	0.0001
14	1,2,3,4,6,7,8-HPCDF	0.01	0.01	0.01
15	1,2,3,4,7,8,9-HPCDF	0.01	0.01	0.01
16	1,2,3,4,7,8-HXCDD	0.5	0.05	0.01
17	1,2,3,4,7,8-HXCDF	0.1	0.1	0.1
18	1,2,3,6,7,8-HXCDD	0.01	0.01	0.1
19	1,2,3,6,7,8-HXCDF	0.1	0.1	0.1
20	1,2,3,7,8,9-HXCDD	0.01	0.1	0.1
21	1,2,3,7,8,9-HXCDF	0.1	0.1	0.1
22	1,2,3,7,8-PECDD	1	1	0.1
23	1,2,3,7,8-PECDF	0.05	0.1	1
24	2,3,4,6,7,8-HXCDF	0.1	0.1	0.05
25	2,3,4,7,8-PECDF	0.5	1	0.1
26	2,3,7,8-TCDF	0.05	1	0.5
27	2,3,7,8-TCDD	1	1	1
28	OCDD	0.0001	0.0001	0.1
29	OCDF	0.0001	0.0001	0.0001

[1]Values with a less than symbol should be considered to be the upper limit for use in any TEQ calculation.

Table G-2. Foraging behavior guilds and focal species.

Foraging Guild	Focal Species
Carnivorous-wading birds	Blue heron, Great egret, Ibis, and Roseate spoonbill
Sediment-probing birds	Willet, Spotted sandpiper, Black-Necked stilt, and Lesser scaup
Piscivorous birds	Belted kingfisher, Osprey, Brown pelican, and Terns
Omnivorous mammals	Raccoon
Piscivorous mammals	River otter and Mink
Carnivorous fish	Black drum, Red drum, Spotted seatrout, and Southern flounder

Table G-3. Exposure model input data and TDIs (mg/kg bw/day) of COPCs for sediment-probing birds.

Chemical of Potential Concern	Area	Ci (mg/kg bw-prey)	MR (kcal/kg bw/day)	GEi (kcal/kg bw/day)	AEi (unitless)	Cs (mg/kg)	IRs (kg bw/day)	TDI (mg/kg bw/day)
Aldrin	Upper Calcasieu River	0.010	994	754	0.660	0.020	0.050	0.021
	Bayou d'Inde	0.010	994	754	0.660	0.050	0.050	0.022
	Middle Calcasieu River	0.005	994	754	0.660	0.030	0.050	0.011
	Reference Areas	0.010	994	754	0.660	0.030	0.050	0.021
Total PCBs	Upper Calcasieu River	0.077	994	754	0.660	0.137	0.050	0.161
	Bayou d'Inde	0.190	994	754	0.660	0.628	0.050	0.411
	Middle Calcasieu River	0.035	994	754	0.660	0.125	0.050	0.076
	Reference Areas	0.050	994	754	0.660	0.328	0.050	0.116
PAHs	Upper Calcasieu River	0.200	994	754	0.660	1.25	0.050	0.462
	Bayou d'Inde	0.200	994	754	0.660	4.00	0.050	0.600
	Middle Calcasieu River	0.029	994	754	0.660	3.90	0.050	0.253
	Reference Areas	0.020	994	754	0.660	0.333	0.050	0.057
2,3,7,8-TCDD-TEQs (Avian)	Upper Calcasieu River	4.31E-05	994	754	0.660	NA	0.050	0.0000861
	Bayou d'Inde	1.97E-04	994	754	0.660	NA	0.050	0.000394
	Middle Calcasieu River	1.98E-05	994	754	0.660	NA	0.050	0.0000395
	Reference Areas	1.38E-06	994	754	0.660	NA	0.050	0.00000275
Cadmium	Upper Calcasieu River	0.050	994	754	0.660	0.800	0.050	0.140
	Bayou d'Inde	0.646	994	754	0.660	1.29	0.050	1.36
	Middle Calcasieu River	0.564	994	754	0.660	0.920	0.050	1.17
	Reference Areas	0.182	994	754	0.660	0.048	0.050	0.365
DDT and Metabolites	Upper Calcasieu River	0.050	994	754	0.660	0.012	0.050	0.100
	Bayou d'Inde	0.050	994	754	0.660	0.024	0.050	0.101
	Middle Calcasieu River	0.050	994	754	0.660	0.016	0.050	0.101
	Reference Areas	0.050	994	754	0.660	0.020	0.050	0.101

Table G-3. Exposure model input data and TDIs (mg/kg bw/day) of COPCs for sediment-probing birds.

Chemical of Potential Concern	Area	Ci (mg/kg bw-prey)	MR (kcal/kg bw/day)	GEi (kcal/kg bw/day)	AEi (unitless)	Cs (mg/kg)	IRs (kg bw/day)	TDI (mg/kg bw/day)
Dieldrin	Upper Calcasieu River	0.010	994	754	0.660	0.020	0.050	0.021
	Bayou d'Inde	0.010	994	754	0.660	0.050	0.050	0.022
	Middle Calcasieu River	0.020	994	754	0.660	0.030	0.050	0.041
	Reference Areas	0.010	994	754	0.660	0.040	0.050	0.022
Di-n-butylphthalate	Upper Calcasieu River	0.220	994	754	0.660	0.748	0.050	0.477
	Bayou d'Inde	0.210	994	754	0.660	1.85	0.050	0.512
	Middle Calcasieu River	0.205	994	754	0.660	1.25	0.050	0.471
	Reference Areas	0.147	994	754	0.660	0.168	0.050	0.302
Lindane (gamma-HCH)	Upper Calcasieu River	0.010	994	754	0.660	0.020	0.050	0.021
	Bayou d'Inde	0.010	994	754	0.660	0.040	0.050	0.022
	Middle Calcasieu River	0.020	994	754	0.660	0.030	0.050	0.041
	Reference Areas	0.020	994	754	0.660	0.040	0.050	0.042
alpha-HCH	Upper Calcasieu River	0.050	994	754	0.660	0.011	0.050	0.100
	Bayou d'Inde	0.050	994	754	0.660	0.020	0.050	0.101
	Middle Calcasieu River	0.050	994	754	0.660	0.014	0.050	0.101
	Reference Areas	0.050	994	754	0.660	0.020	0.050	0.101
beta-HCH	Upper Calcasieu River	0.050	994	754	0.660	0.011	0.050	0.101
	Bayou d'Inde	0.050	994	754	0.660	0.150	0.050	0.107
	Middle Calcasieu River	0.050	994	754	0.660	0.014	0.050	0.101
	Reference Areas	0.050	994	754	0.660	0.020	0.050	0.101
delta-HCH	Upper Calcasieu River	0.050	994	754	0.660	0.011	0.050	0.100
	Bayou d'Inde	0.050	994	754	0.660	0.023	0.050	0.101
	Middle Calcasieu River	0.050	994	754	0.660	0.014	0.050	0.101
	Reference Areas	0.050	994	754	0.660	0.020	0.050	0.101

Table G-3. Exposure model input data and TDIs (mg/kg bw/day) of COPCs for sediment-probing birds.

Chemical of Potential Concern	Area	Ci (mg/kg bw-prey)	MR (kcal/kg bw/day)	GEi (kcal/kg bw/day)	AEi (unitless)	Cs (mg/kg)	IRs (kg bw/day)	TDI (mg/kg bw/day)
Hexachlorobenzene	Upper Calcasieu River	0.060	994	754	0.660	0.747	0.050	0.157
	Bayou d'Inde	0.026	994	754	0.660	2.35	0.050	0.170
	Middle Calcasieu River	0.060	994	754	0.660	1.25	0.050	0.182
	Reference Areas	0.040	994	754	0.660	0.168	0.050	0.088
Hexachlorobutadiene	Upper Calcasieu River	2	994	754	0.660	1	0.050	4.04
	Bayou d'Inde	2	994	754	0.660	3.80	0.050	4.18
	Middle Calcasieu River	2	994	754	0.660	2.50	0.050	4.12
	Reference Areas	2	994	754	0.660	0.330	0.050	4.01
Lead	Upper Calcasieu River	1.22	994	754	0.660	118	0.050	14.2
	Bayou d'Inde	0.524	994	754	0.660	198	0.050	20.9
	Middle Calcasieu River	0.276	994	754	0.660	76.9	0.050	8.23
	Reference Areas	1.57	994	754	0.660	27.9	0.050	5.93
Mercury	Upper Calcasieu River	0.110	994	754	0.660	0.001	0.050	0.22
	Bayou d'Inde	0.086	994	754	0.660	0.106	0.050	0.18
	Middle Calcasieu River	0.100	994	754	0.660	0.008	0.050	0.20
	Reference Areas	0.048	994	754	0.660	0.000	0.050	0.10
Selenium	Upper Calcasieu River	0.946	994	754	0.660	1.25	0.050	1.95
	Bayou d'Inde	0.754	994	754	0.660	2.33	0.050	1.62
	Middle Calcasieu River	1.27	994	754	0.660	1.95	0.050	2.63
	Reference Areas	0.719	994	754	0.660	0.75	0.050	1.47

NA = Not available; NC = Not calculated; PAHs = Polycyclic aromatic hydrocarbons (represented by Benzo(a)pyrene);

C_i = Concentration in prey; FMR = Metabolic rate; GE_i = Gross energy; AE_i = Assimilation efficiency; C_s = Sediment concentration;

IRs = Ingestion rate; TDI = Total daily intake.

Table G-4. Exposure model input data and TDIs (mg/kg bw/day) of COPCs for carnivorous-wading birds.

Chemical of Potential Concern	Area	Ci (mg/kg bw-prey)	MR (kcal/kg bw/day)	GEi (kcal/kg bw/day)	AEi (unitless)	Cs (mg/kg)	IRs (kg bw/day)	TDI (mg/kg bw/day)
Aldrin	Upper Calcasieu River	0.010	397	850	0.716	NA	NA	0.007
	Bayou d'Inde	0.010	397	850	0.716	NA	NA	0.007
	Middle Calcasieu River	0.010	397	850	0.716	NA	NA	0.007
	Reference Areas	0.010	397	850	0.716	NA	NA	0.007
Total PCBs	Upper Calcasieu River	0.019	397	850	0.716	NA	NA	0.012
	Bayou d'Inde	0.516	397	850	0.716	NA	NA	0.337
	Middle Calcasieu River	0.071	397	850	0.716	NA	NA	0.046
	Reference Areas	0.290	397	850	0.716	NA	NA	0.189
PAHs	Upper Calcasieu	0.240	397	850	0.716	NA	NA	0.157
	Bayou d'Inde	0.200	397	850	0.716	NA	NA	0.130
	Middle Calcasieu	0.325	397	850	0.716	NA	NA	0.212
	Reference Areas	0.400	397	850	0.716	NA	NA	0.261
Cadmium	Upper Calcasieu River	0.010	397	850	0.716	NA	NA	0.007
	Bayou d'Inde	0.010	397	850	0.716	NA	NA	0.007
	Middle Calcasieu River	0.003	397	850	0.716	NA	NA	0.002
	Reference Areas	0.009	397	850	0.716	NA	NA	0.006
DDT and Metabolites	Upper Calcasieu River	0.010	397	850	0.716	NA	NA	0.007
	Bayou d'Inde	0.010	397	850	0.716	NA	NA	0.007
	Middle Calcasieu River	0.010	397	850	0.716	NA	NA	0.007
	Reference Areas	0.010	397	850	0.716	NA	NA	0.007
Dieldrin	Upper Calcasieu River	0.010	397	850	0.716	NA	NA	0.007
	Bayou d'Inde	0.010	397	850	0.716	NA	NA	0.007
	Middle Calcasieu River	0.010	397	850	0.716	NA	NA	0.007
	Reference Areas	0.010	397	850	0.716	NA	NA	0.007

Table G-4. Exposure model input data and TDIs (mg/kg bw/day) of COPCs for carnivorous-wading birds.

Chemical of Potential Concern	Area	Ci (mg/kg bw-prey)	MR (kcal/kg bw/day)	GEi (kcal/kg bw/day)	AEi (unitless)	Cs (mg/kg)	IRs (kg bw/day)	TDI (mg/kg bw/day)
Di-n-butylphthalate	Upper Calcasieu River	0.136	397	850	0.716	NA	NA	0.089
	Bayou d'Inde	0.200	397	850	0.716	NA	NA	0.130
	Middle Calcasieu River	0.200	397	850	0.716	NA	NA	0.130
	Reference Areas	0.194	397	850	0.716	NA	NA	0.127
Lindane (gamma-HCH)	Upper Calcasieu River	0.010	397	850	0.716	NA	NA	0.007
	Bayou d'Inde	0.010	397	850	0.716	NA	NA	0.007
	Middle Calcasieu River	0.010	397	850	0.716	NA	NA	0.007
	Reference Areas	0.010	397	850	0.716	NA	NA	0.007
HCH-isomers (alpha)	Upper Calcasieu River	0.005	397	850	0.716	NA	NA	0.003
	Bayou d'Inde	0.005	397	850	0.716	NA	NA	0.003
	Middle Calcasieu River	0.005	397	850	0.716	NA	NA	0.003
	Reference Areas	0.005	397	850	0.716	NA	NA	0.003
HCH-isomers (beta)	Upper Calcasieu River	0.005	397	850	0.716	NA	NA	0.003
	Bayou d'Inde	0.012	397	850	0.716	NA	NA	0.008
	Middle Calcasieu River	0.005	397	850	0.716	NA	NA	0.003
	Reference Areas	0.005	397	850	0.716	NA	NA	0.003
HCH-isomers (delta)	Upper Calcasieu River	0.005	397	850	0.716	NA	NA	0.003
	Bayou d'Inde	0.005	397	850	0.716	NA	NA	0.003
	Middle Calcasieu River	0.005	397	850	0.716	NA	NA	0.003
	Reference Areas	0.005	397	850	0.716	NA	NA	0.003
Hexachlorobenzene	Upper Calcasieu River	0.225	397	850	0.716	NA	NA	0.147
	Bayou d'Inde	0.200	397	850	0.716	NA	NA	0.130
	Middle Calcasieu River	0.320	397	850	0.716	NA	NA	0.209
	Reference Areas	0.400	397	850	0.716	NA	NA	0.263

Table G-4. Exposure model input data and TDIs (mg/kg bw/day) of COPCs for carnivorous-wading birds.

Chemical of Potential Concern	Area	Ci (mg/kg bw-prey)	MR (kcal/kg bw/day)	GEi (kcal/kg bw/day)	AEi (unitless)	Cs (mg/kg)	IRs (kg bw/day)	TDI (mg/kg bw/day)
Hexachlorobutadiene	Upper Calcasieu River	0.490	397	850	0.716	NA	NA	0.320
	Bayou d'Inde	0.400	397	850	0.716	NA	NA	0.261
	Middle Calcasieu River	0.600	397	850	0.716	NA	NA	0.391
	Reference Areas	0.760	397	850	0.716	NA	NA	0.496
Lead	Upper Calcasieu River	0.517	397	850	0.716	NA	NA	0.337
	Bayou d'Inde	1.100	397	850	0.716	NA	NA	0.718
	Middle Calcasieu River	0.566	397	850	0.716	NA	NA	0.369
	Reference Areas	0.175	397	850	0.716	NA	NA	0.114
Mercury	Upper Calcasieu	0.109	397	850	0.716	NA	NA	0.071
	Bayou d'Inde	0.505	397	850	0.716	NA	NA	0.329
	Middle Calcasieu	0.116	397	850	0.716	NA	NA	0.076
	Reference Areas	0.046	397	850	0.716	NA	NA	0.030
Selenium	Upper Calcasieu River	0.521	397	850	0.716	NA	NA	0.340
	Bayou d'Inde	0.756	397	850	0.716	NA	NA	0.493
	Middle Calcasieu River	0.574	397	850	0.716	NA	NA	0.374
	Reference Areas	0.376	397	850	0.716	NA	NA	0.245
2,3,7,8-TCDD-TEQs (Avian)	Upper Calcasieu River	1.08E-05	397	850	0.716	NA	NA	0.00000705
	Bayou d'Inde	6.71E-05	397	850	0.716	NA	NA	0.0000438
	Middle Calcasieu River	5.89E-05	397	850	0.716	NA	NA	0.0000384
	Reference Areas	2.93E-05	397	850	0.716	NA	NA	0.0000191

NA = Not available; NC = Not calculated; PAHs = Polycyclic aromatic hydrocarbons (represented by Benzo(a)pyrene);

C_i = Concentration in prey; FMR = Metabolic rate; GE_i = Gross energy; AE_i = Assimilation efficiency; C_s = Sediment concentration;

IRs = Ingestion rate; TDI = Total daily intake.

Table G-5. Exposure model input data and TDIs (mg/kg bw/day) of COPCs for omnivorous mammals.

Chemical of Potential Concern	Area	Ci (mg/kg bw-prey)	MR (kcal/kg bw/day)	GEi (kcal/kg bw/day)	AEi (unitless)	Cs (mg/kg)	IRs (kg bw/day)	TDI (mg/kg bw/day)
Aldrin	Upper Calcasieu River	0.010	187	850	0.91	NA	NA	0.002
	Bayou d'Inde	0.010	187	850	0.91	NA	NA	0.002
	Middle Calcasieu River	0.010	187	850	0.91	NA	NA	0.002
	Reference Areas	0.010	187	850	0.91	NA	NA	0.002
Total PCBs	Upper Calcasieu River	0.019	187	850	0.91	NA	NA	0.005
	Bayou d'Inde	0.516	187	850	0.91	NA	NA	0.125
	Middle Calcasieu River	0.071	187	850	0.91	NA	NA	0.017
	Reference Areas	0.290	187	850	0.91	NA	NA	0.070
PAHs	Upper Calcasieu River	0.498	187	850	0.91	NA	NA	0.120
	Bayou d'Inde	0.400	187	850	0.91	NA	NA	0.097
	Middle Calcasieu River	0.600	187	850	0.91	NA	NA	0.145
	Reference Areas	0.760	187	850	0.91	NA	NA	0.184
Cadmium	Upper Calcasieu River	0.010	187	850	0.91	NA	NA	0.002
	Bayou d'Inde	0.010	187	850	0.91	NA	NA	0.002
	Middle Calcasieu River	0.003	187	850	0.91	NA	NA	0.001
	Reference Areas	0.009	187	850	0.91	NA	NA	0.002
DDT and Metabolites	Upper Calcasieu River	0.010	187	850	0.91	NA	NA	0.002
	Bayou d'Inde	0.010	187	850	0.91	NA	NA	0.002
	Middle Calcasieu River	0.010	187	850	0.91	NA	NA	0.002
	Reference Areas	0.010	187	850	0.91	NA	NA	0.002
Dieldrin	Upper Calcasieu River	0.010	187	850	0.91	NA	NA	0.002
	Bayou d'Inde	0.010	187	850	0.91	NA	NA	0.002
	Middle Calcasieu River	0.010	187	850	0.91	NA	NA	0.002
	Reference Areas	0.010	187	850	0.91	NA	NA	0.002

Table G-5. Exposure model input data and TDIs (mg/kg bw/day) of COPCs for omnivorous mammals.

Chemical of Potential Concern	Area	Ci (mg/kg bw-prey)	MR (kcal/kg bw/day)	GEi (kcal/kg bw/day)	AEi (unitless)	Cs (mg/kg)	IRs (kg bw/day)	TDI (mg/kg bw/day)
Di-n-butylphthalate	Upper Calcasieu River	0.488	187	850	0.91	NA	NA	0.118
	Bayou d'Inde	5.00	187	850	0.91	NA	NA	1.21
	Middle Calcasieu River	7.30	187	850	0.91	NA	NA	1.76
	Reference Areas	1.95	187	850	0.91	NA	NA	0.471
Lindane (gamma-HCH)	Upper Calcasieu River	0.010	187	850	0.91	NA	NA	0.002
	Bayou d'Inde	0.010	187	850	0.91	NA	NA	0.002
	Middle Calcasieu River	0.010	187	850	0.91	NA	NA	0.002
	Reference Areas	0.010	187	850	0.91	NA	NA	0.002
alpha-HCH	Upper Calcasieu River	0.005	187	850	0.91	NA	NA	0.001
	Bayou d'Inde	0.005	187	850	0.91	NA	NA	0.001
	Middle Calcasieu River	0.005	187	850	0.91	NA	NA	0.001
	Reference Areas	0.005	187	850	0.91	NA	NA	0.001
beta-HCH	Upper Calcasieu River	0.005	187	850	0.91	NA	NA	0.001
	Bayou d'Inde	0.012	187	850	0.91	NA	NA	0.003
	Middle Calcasieu River	0.005	187	850	0.91	NA	NA	0.001
	Reference Areas	0.005	187	850	0.91	NA	NA	0.001
delta-HCH	Upper Calcasieu River	0.005	187	850	0.91	NA	NA	0.001
	Bayou d'Inde	0.005	187	850	0.91	NA	NA	0.001
	Middle Calcasieu River	0.005	187	850	0.91	NA	NA	0.001
	Reference Areas	0.005	187	850	0.91	NA	NA	0.001
Hexachlorobenzene	Upper Calcasieu River	0.225	187	850	0.91	NA	NA	0.054
	Bayou d'Inde	0.200	187	850	0.91	NA	NA	0.048
	Middle Calcasieu River	0.320	187	850	0.91	NA	NA	0.077
	Reference Areas	0.400	187	850	0.91	NA	NA	0.097

Table G-5. Exposure model input data and TDIs (mg/kg bw/day) of COPCs for omnivorous mammals.

Chemical of Potential Concern	Area	Ci (mg/kg bw-prey)	MR (kcal/kg bw/day)	GEi (kcal/kg bw/day)	AEi (unitless)	Cs (mg/kg)	IRs (kg bw/day)	TDI (mg/kg bw/day)
Hexachlorobutadiene	Upper Calcasieu River	0.490	187	850	0.91	NA	NA	0.118
	Bayou d'Inde	0.400	187	850	0.91	NA	NA	0.097
	Middle Calcasieu River	0.600	187	850	0.91	NA	NA	0.145
	Reference Areas	0.760	187	850	0.91	NA	NA	0.184
Lead	Upper Calcasieu River	0.525	187	850	0.91	NA	NA	0.127
	Bayou d'Inde	1.15	187	850	0.91	NA	NA	0.278
	Middle Calcasieu River	0.587	187	850	0.91	NA	NA	0.142
	Reference Areas	0.067	187	850	0.91	NA	NA	0.016
Mercury	Upper Calcasieu River	0.109	187	850	0.91	NA	NA	0.004
	Bayou d'Inde	0.505	187	850	0.91	NA	NA	0.017
	Middle Calcasieu River	0.116	187	850	0.91	NA	NA	0.004
	Reference Areas	0.046	187	850	0.91	NA	NA	0.002
Selenium	Upper Calcasieu River	0.521	187	850	0.91	NA	NA	0.126
	Bayou d'Inde	0.756	187	850	0.91	NA	NA	0.183
	Middle Calcasieu River	0.574	187	850	0.91	NA	NA	0.139
	Reference Areas	0.376	187	850	0.91	NA	NA	0.091
2,3,7,8-TCDD-TEQs (Mammalian)	Upper Calcasieu River	0.00000784	187	850	0.91	NA	NA	0.00000190
	Bayou d'Inde	0.0000278	187	850	0.91	NA	NA	0.00000673
	Middle Calcasieu River	0.0000230	187	850	0.91	NA	NA	0.00000556
	Reference Areas	0.00000986	187	850	0.91	NA	NA	0.00000240

NA = Not available; NC = Not calculated; PAHs = Polycyclic aromatic hydrocarbons (represented by Benzo(a)pyrene);

C_i = Concentration in prey; FMR = Metabolic rate; GE_i = Gross energy; AE_i = Assimilation efficiency; C_s = Sediment concentration;

IRs = Ingestion rate; TDI = Total daily intake.

Table G-6. Exposure model input data and TDIs (mg/kg bw/day) of COPCs for piscivorus birds.

Chemical of Potential Concern	Area	Ci (mg/kg bw-prey)	MR (kcal/kg bw/day)	GEi (kcal/kg bw/day)	AEi (unitless)	Cs (mg/kg)	IRs (kg bw/day)	TDI (mg/kg bw/day)
Aldrin	Upper Calcasieu River	0.005	693	850	0.716	NA	NA	0.006
	Bayou d'Inde	0.005	693	850	0.716	NA	NA	0.006
	Middle Calcasieu River	0.005	693	850	0.716	NA	NA	0.006
	Reference Areas	0.005	693	850	0.716	NA	NA	0.006
Total PCBs	Upper Calcasieu River	0.019	693	850	0.716	NA	NA	0.022
	Bayou d'Inde	0.516	693	850	0.716	NA	NA	0.588
	Middle Calcasieu River	0.071	693	850	0.716	NA	NA	0.081
	Reference Areas	0.290	693	850	0.716	NA	NA	0.330
PAHs	Upper Calcasieu River	0.240	693	850	0.716	NA	NA	0.273
	Bayou d'Inde	0.200	693	850	0.716	NA	NA	0.228
	Middle Calcasieu River	0.325	693	850	0.716	NA	NA	0.370
	Reference Areas	0.400	693	850	0.716	NA	NA	0.455
alpha-HCH	Upper Calcasieu River	0.005	693	850	0.716	NA	NA	0.057
	Bayou d'Inde	0.005	693	850	0.716	NA	NA	0.057
	Middle Calcasieu River	0.005	693	850	0.716	NA	NA	0.057
	Reference Areas	0.005	693	850	0.716	NA	NA	0.057
beta-HCH	Upper Calcasieu River	0.005	693	850	0.716	NA	NA	0.057
	Bayou d'Inde	0.012	693	850	0.716	NA	NA	0.014
	Middle Calcasieu River	0.005	693	850	0.716	NA	NA	0.057
	Reference Areas	0.005	693	850	0.716	NA	NA	0.057
delta-HCH	Upper Calcasieu River	0.005	693	850	0.716	NA	NA	0.057
	Bayou d'Inde	0.005	693	850	0.716	NA	NA	0.057
	Middle Calcasieu River	0.005	693	850	0.716	NA	NA	0.057
	Reference Areas	0.005	693	850	0.716	NA	NA	0.057

Table G-6. Exposure model input data and TDIs (mg/kg bw/day) of COPCs for piscivorus birds.

Chemical of Potential Concern	Area	Ci (mg/kg bw-prey)	MR (kcal/kg bw/day)	GEi (kcal/kg bw/day)	AEi (unitless)	Cs (mg/kg)	IRs (kg bw/day)	TDI (mg/kg bw/day)
Cadmium	Upper Calcasieu River	0.010	693	850	0.716	NA	NA	0.011
	Bayou d'Inde	0.010	693	850	0.716	NA	NA	0.011
	Middle Calcasieu River	0.003	693	850	0.716	NA	NA	0.003
	Reference Areas	0.009	693	850	0.716	NA	NA	0.010
DDT and Metabolites	Upper Calcasieu River	0.010	693	850	0.716	NA	NA	0.011
	Bayou d'Inde	0.010	693	850	0.716	NA	NA	0.011
	Middle Calcasieu River	0.010	693	850	0.716	NA	NA	0.011
	Reference Areas	0.010	693	850	0.716	NA	NA	0.011
Dieldrin	Upper Calcasieu River	0.010	693	850	0.716	NA	NA	0.011
	Bayou d'Inde	0.010	693	850	0.716	NA	NA	0.011
	Middle Calcasieu River	0.010	693	850	0.716	NA	NA	0.011
	Reference Areas	0.010	693	850	0.716	NA	NA	0.011
Di-n-butylphthalate	Upper Calcasieu River	0.136	693	850	0.716	NA	NA	0.155
	Bayou d'Inde	0.200	693	850	0.716	NA	NA	0.228
	Middle Calcasieu River	0.200	693	850	0.716	NA	NA	0.228
	Reference Areas	0.194	693	850	0.716	NA	NA	0.221
Lindane (gamma-HCH)	Upper Calcasieu River	0.010	693	850	0.716	NA	NA	0.011
	Bayou d'Inde	0.010	693	850	0.716	NA	NA	0.011
	Middle Calcasieu River	0.010	693	850	0.716	NA	NA	0.011
	Reference Areas	0.010	693	850	0.716	NA	NA	0.011
Hexachlorobenzene	Upper Calcasieu River	0.225	693	850	0.716	NA	NA	0.256
	Bayou d'Inde	0.200	693	850	0.716	NA	NA	0.228
	Middle Calcasieu River	0.320	693	850	0.716	NA	NA	0.364
	Reference Areas	0.100	693	850	0.716	NA	NA	0.114

Table G-6. Exposure model input data and TDIs (mg/kg bw/day) of COPCs for piscivorus birds.

Chemical of Potential Concern	Area	Ci (mg/kg bw-prey)	MR (kcal/kg bw/day)	GEi (kcal/kg bw/day)	AEi (unitless)	Cs (mg/kg)	IRs (kg bw/day)	TDI (mg/kg bw/day)
Hexachlorobutadiene	Upper Calcasieu River	0.225	693	850	0.716	NA	NA	0.256
	Bayou d'Inde	0.200	693	850	0.716	NA	NA	0.228
	Middle Calcasieu River	0.320	693	850	0.716	NA	NA	0.364
	Reference Areas	0.400	693	850	0.716	NA	NA	0.455
Lead	Upper Calcasieu River	0.517	693	850	0.716	NA	NA	0.589
	Bayou d'Inde	1.10	693	850	0.716	NA	NA	1.25
	Middle Calcasieu River	0.566	693	850	0.716	NA	NA	0.644
	Reference Areas	0.175	693	850	0.716	NA	NA	0.199
Mercury	Upper Calcasieu River	0.109	693	850	0.716	NA	NA	0.124
	Bayou d'Inde	0.505	693	850	0.716	NA	NA	0.575
	Middle Calcasieu River	0.116	693	850	0.716	NA	NA	0.132
	Reference Areas	0.046	693	850	0.716	NA	NA	0.052
Selenium	Upper Calcasieu River	0.521	693	850	0.716	NA	NA	0.593
	Bayou d'Inde	0.756	693	850	0.716	NA	NA	0.861
	Middle Calcasieu River	0.574	693	850	0.716	NA	NA	0.654
	Reference Areas	0.376	693	850	0.716	NA	NA	0.428
2,3,7,8-TCDD-TEQs (Avian)	Upper Calcasieu River	0.0000108	693	850	0.716	NA	NA	0.0000123
	Bayou d'Inde	0.0000671	693	850	0.716	NA	NA	0.0000764
	Middle Calcasieu River	0.0000589	693	850	0.716	NA	NA	0.0000671
	Reference Areas	0.0000293	693	850	0.716	NA	NA	0.0000333

NA = Not available; NC = Not calculated; PAHs = Polycyclic aromatic hydrocarbons (represented by Benzo(a)pyrene);

C_i = Concentration in prey; FMR = Metabolic rate; GE_i = Gross energy; AE_i = Assimilation efficiency; C_s = Sediment concentration;

IRs = Ingestion rate; TDI = Total daily intake.

Table G-7. Exposure model input data and TDIs (mg/kg bw/day) of COPCs for piscivorus mammals.

Chemical of Potential Concern	Area	Ci[1] (mg/kg bw-prey)	MR (kcal/kg bw/day)	GEi (kcal/kg bw/day)	AEi (unitless)	Cs (mg/kg)	IRs (kg bw/day)	TDI (mg/kg bw/day)
Aldrin	Upper Calcasieu River	0.01 / 0.013	400	850	0.91	NA	NA	0.004
	Bayou d'Inde	0.01 / 0.05	400	850	0.91	NA	NA	0.012
	Middle Calcasieu River	0.01 / 0.013	400	850	0.91	NA	NA	0.004
	Reference Areas	0.01 / 0.01	400	850	0.91	NA	NA	0.004
Total PCBs	Upper Calcasieu River	0.019 / 0.589	400	850	0.91	NA	NA	0.125
	Bayou d'Inde	0.516 / 1.26	400	850	0.91	NA	NA	0.340
	Middle Calcasieu River	0.071 / 0.484	400	850	0.91	NA	NA	0.111
	Reference Areas	0.29 / 0.438	400	850	0.91	NA	NA	0.135
PAHs	Upper Calcasieu River	0.24 / 0.025	400	850	0.91	NA	NA	0.042
	Bayou d'Inde	0.2 / 0.025	400	850	0.91	NA	NA	0.036
	Middle Calcasieu River	0.325 / 0.025	400	850	0.91	NA	NA	0.056
	Reference Areas	0.4 / 0.025	400	850	0.91	NA	NA	0.067
alpha-HCH	Upper Calcasieu River	0.005 / 0.005	400	850	0.91	NA	NA	0.002
	Bayou d'Inde	0.005 / 0.005	400	850	0.91	NA	NA	0.002
	Middle Calcasieu River	0.005 / 0.005	400	850	0.91	NA	NA	0.002
	Reference Areas	0.005 / 0.005	400	850	0.91	NA	NA	0.002
beta-HCH	Upper Calcasieu River	0.005 / 0.039	400	850	0.91	NA	NA	0.009
	Bayou d'Inde	0.012 / 0.165	400	850	0.91	NA	NA	0.036
	Middle Calcasieu River	0.005 / 0.027	400	850	0.91	NA	NA	0.006
	Reference Areas	0.005 / 0.005	400	850	0.91	NA	NA	0.002
Cadmium	Upper Calcasieu River	0.01 / 0.01	400	850	0.91	NA	NA	0.004
	Bayou d'Inde	0.01 / 0.01	400	850	0.91	NA	NA	0.004
	Middle Calcasieu River	0.003 / 0.01	400	850	0.91	NA	NA	0.003
	Reference Areas	0.009 / 0.01	400	850	0.91	NA	NA	0.003

Table G-7. Exposure model input data and TDIs (mg/kg bw/day) of COPCs for piscivorus mammals.

Chemical of Potential Concern	Area	Ci^1 (mg/kg bw-prey)	MR (kcal/kg bw/day)	GEi (kcal/kg bw/day)	AEi (unitless)	Cs (mg/kg)	IRs (kg bw/day)	TDI (mg/kg bw/day)
DDT and Metabolites	Upper Calcasieu River	0.01 / 0.014	400	850	0.91	NA	NA	0.004
	Bayou d'Inde	0.01 / 0.026	400	850	0.91	NA	NA	0.007
	Middle Calcasieu River	0.01 / 0.015	400	850	0.91	NA	NA	0.005
	Reference Areas	0.01 / 0.01	400	850	0.91	NA	NA	0.004
Dieldrin	Upper Calcasieu River	0.01 / 0.01	400	850	0.91	NA	NA	0.004
	Bayou d'Inde	0.01 / 0.017	400	850	0.91	NA	NA	0.005
	Middle Calcasieu River	0.01 / 0.013	400	850	0.91	NA	NA	0.004
	Reference Areas	0.01 / 0.01	400	850	0.91	NA	NA	0.004
Di-n-butylphthalate	Upper Calcasieu River	0.268 / 0.094	400	850	0.91	NA	NA	0.061
	Bayou d'Inde	4.800	400	850	0.91	NA	NA	0.786
	Middle Calcasieu River	6.9 / 0.102	400	850	0.91	NA	NA	1.09
	Reference Areas	1.02 / 0.182	400	850	0.91	NA	NA	0.195
Lindane (gamma-HCH)	Upper Calcasieu River	0.01 / 0.01	400	850	0.91	NA	NA	0.004
	Bayou d'Inde	0.01 / 0.01	400	850	0.91	NA	NA	0.004
	Middle Calcasieu River	0.01 / 0.01	400	850	0.91	NA	NA	0.004
	Reference Areas	0.01 / 0.01	400	850	0.91	NA	NA	0.004
Hexachlorobenzene	Upper Calcasieu River	0.225 / 0.025	400	850	0.91	NA	NA	0.040
	Bayou d'Inde	0.2 / 0.139	400	850	0.91	NA	NA	0.060
	Middle Calcasieu River	0.32 / 0.063	400	850	0.91	NA	NA	0.063
	Reference Areas	0.4 / 0.025	400	850	0.91	NA	NA	0.067
Hexachlorobutadiene	Upper Calcasieu River	0.225 / 0.154	400	850	0.91	NA	NA	0.067
	Bayou d'Inde	0.2 / 0.134	400	850	0.91	NA	NA	0.059
	Middle Calcasieu River	0.32 / 0.159	400	850	0.91	NA	NA	0.083
	Reference Areas	0.4 / 0.09	400	850	0.91	NA	NA	0.081

Table G-7. Exposure model input data and TDIs (mg/kg bw/day) of COPCs for piscivorus mammals.

Chemical of Potential Concern	Area	Ci[1] (mg/kg bw-prey)	MR (kcal/kg bw/day)	GEi (kcal/kg bw/day)	AEi (unitless)	Cs (mg/kg)	IRs (kg bw/day)	TDI (mg/kg bw/day)
Lead	Upper Calcasieu River	0.517 / 3.36	400	850	0.91	NA	NA	0.774
	Bayou d'Inde	1.1 / 1.05	400	850	0.91	NA	NA	0.388
	Middle Calcasieu River	0.566 / 0.362	400	850	0.91	NA	NA	0.163
	Reference Areas	0.175 / 0.205	400	850	0.91	NA	NA	0.070
Mercury	Upper Calcasieu River	0.109 / 0.138	400	850	0.91	NA	NA	0.038
	Bayou d'Inde	0.505 / 0.308	400	850	0.91	NA	NA	0.142
	Middle Calcasieu River	0.116 / 0.179	400	850	0.91	NA	NA	0.046
	Reference Areas	0.046 / 0.097	400	850	0.91	NA	NA	0.027
Selenium	Upper Calcasieu River	0.521 / 0.708	400	850	0.91	NA	NA	0.227
	Bayou d'Inde	0.756 / 0.662	400	850	0.91	NA	NA	0.254
	Middle Calcasieu River	0.574 / 0.985	400	850	0.91	NA	NA	0.293
	Reference Areas	0.376 / 0.760	400	850	0.91	NA	NA	0.216
2,3,7,8-TCDD-TEQs (Mammalian)	Upper Calcasieu River	0.000008 / 0.00005	400	850	0.91	NA	NA	0.0000113
	Bayou d'Inde	0.00003 / 0.0002	400	850	0.91	NA	NA	0.0000344
	Middle Calcasieu River	0.00002 / 0.00006	400	850	0.91	NA	NA	0.0000163
	Reference Areas	0.00001 / 0.000005	400	850	0.91	NA	NA	0.00000254

[1] Group 1 prey / Group 4 prey

NA = Not available; NC = Not calculated; PAHs = Polycyclic aromatic hydrocarbons (represented by Benzo(a)pyrene);

C_i = Concentration in prey; FMR = Metabolic rate; GE_i = Gross energy; AE_i = Assimilation efficiency; C_s = Sediment concentration;

IRs = Ingestion rate; TDI = Total daily intake.

Table G-8. Grouping of prey fish for the Calcasieu Estuary deterministic risk assessment.

Group	Description of Group	Species	Size Class (cm)
Fish			
1	Small sedentary species - Low trophic level (<2.5)	killfish, sheepshead minnows, blennies, gobies, midshipman, mollies	< 15
2A	Small migratory species - Low trophic level (<2.5)	mullet, shad, anchovies, sunfish, spadefish, menhaden, herring, silverside	< 15
2B	Small migratory species - High trophic level (>2.5)	puffer, spot, croaker, whiff, pinfish	< 15
3A	Medium migratory species - Low trophic level (<2.5)	mullet, shad, spadefish, menhaden, herring, sunfish	15 - < 30
3B	Medium migratory species - High trophic level (>2.5)	puffer, spot, croaker, whiff, pinfish, seatrout, black drum, red drum	15 - < 30
4A	Large migratory species - Low trophic level (<2.5)	mullet, shad	30 - 90
4B	Large migratory species - High trophic level (>2.5)	croaker, red drum, black drum, flounder	30 -90
Invertebrates			
1A	Small sedentary bivalves	*Rangia* clams, mussels, oysters	< 7.5
1B	Small sedentary crustaceans	fiddler crabs, hermit crabs, juvenile blue crabs	< 7.5
2A	Small migratory crustaceans	shrimp	< 12.5
2B	Large migratory crustaceans	blue crabs	> 12.5

Table G-9. Calculated risk quotients (RQs) for COPCs for carnivorous fish in the Calcasieu River Estuary.

Chemical of Potential Concern	Area	Black Drum Whole Body Burden (mg/kg)	Fish NOAEL Tissue Residue Value (mg/kg)	Fish LOAEL Tissue Residue Value (mg/kg)	Fish ChV Tissue Residue Value (mg/kg)	RQ_{NOAEL}	RQ_{LOAEL}	RQ_{ChV}
Aldrin	Upper Calcasieu River	0.01	0.081	0.81	0.256	0.123	0.012	0.039
	Bayou d'Inde	0.01	0.081	0.81	0.256	0.123	0.012	0.039
	Middle Calcasieu River	0.01	0.081	0.81	0.256	0.123	0.012	0.039
	Reference Areas	0.01	0.081	0.81	0.256	0.123	0.012	0.039
PAHs	Upper Calcasieu River	0.03	10.2	12.3	11.2	0.002	0.002	0.002
	Bayou d'Inde	0.03	10.2	12.3	11.2	0.002	0.002	0.002
	Middle Calcasieu River	0.03	10.2	12.3	11.2	0.002	0.002	0.002
	Reference Areas	0.03	10.2	12.3	11.2	0.002	0.002	0.002
Cadmium	Upper Calcasieu River	0.01	0.54	0.96	0.720	0.009	0.005	0.007
	Bayou d'Inde	0.004	0.54	0.96	0.720	0.007	0.004	0.006
	Middle Calcasieu River	NA	0.54	0.96	0.720	NC	NC	NC
	Reference Areas	0.01	0.54	0.96	0.720	0.017	0.009	0.0
DDT and metabolites	Upper Calcasieu River	0.01	1.92	19.2	6.1	0.003	0.0003	0.001
	Bayou d'Inde	0.07	1.92	19.2	6.1	0.035	0.004	0.011
	Middle Calcasieu River	0.01	1.92	19.2	6.1	0.004	0.0004	0.001
	Reference Areas	0.01	1.92	19.2	6.1	0.003	0.0003	0.001
Dieldrin	Upper Calcasieu River	0.01	0.548	5.48	1.7	0.018	0.002	0.316
	Bayou d'Inde	0.01	0.548	5.48	1.7	0.018	0.002	0.316
	Middle Calcasieu River	0.01	0.548	5.48	1.7	0.018	0.002	0.316
	Reference Areas	0.01	0.548	5.48	1.7	0.018	0.002	0.316
Di-n-butylphthalate	Upper Calcasieu River	0.07	0.027	0.27	0.085	2.7	0.3	0.9
	Bayou d'Inde	0.20	0.027	0.27	0.085	7.4	0.7	2.3
	Middle Calcasieu River	0.10	0.027	0.27	0.085	3.8	0.4	1.2
	Reference Areas	0.18	0.027	0.27	0.085	6.7	0.7	2.1

Table G-9. Calculated risk quotients (RQs) for COPCs for carnivorous fish in the Calcasieu River Estuary.

Chemical of Potential Concern	Area	Black Drum Whole Body Burden (mg/kg)	Fish NOAEL Tissue Residue Value (mg/kg)	Fish LOAEL Tissue Residue Value (mg/kg)	Fish ChV Tissue Residue Value (mg/kg)	RQ_{NOAEL}	RQ_{LOAEL}	RQ_{ChV}
alpha-HCH	Upper Calcasieu River	0.01	0.16	1.6	0.506	0.031	0.003	0.010
	Bayou d'Inde	0.01	0.16	1.6	0.506	0.031	0.003	0.010
	Middle Calcasieu River	0.01	0.16	1.6	0.506	0.031	0.003	0.010
	Reference Areas	0.01	0.16	1.6	0.506	0.031	0.003	0.010
beta-HCH	Upper Calcasieu River	0.0385	0.16	1.6	0.506	0.241	0.024	0.076
	Bayou d'Inde	0.1655	0.16	1.6	0.506	1.034	0.103	0.327
	Middle Calcasieu River	0.0265	0.16	1.6	0.506	0.166	0.017	0.052
	Reference Areas	0.0050	0.16	1.6	0.506	0.031	0.003	0.010
Hexachlorobenzene	Upper Calcasieu River	0.03	0.16	1.6	0.506	0.156	0.016	0.049
	Bayou d'Inde	0.14	0.16	1.6	0.506	0.863	0.086	0.273
	Middle Calcasieu River	0.06	0.16	1.6	0.506	0.388	0.039	0.123
	Reference Areas	0.03	0.16	1.6	0.506	0.156	0.016	0.049
Hexachlorobutadiene	Upper Calcasieu River	0.15	0.063	0.63	0.199	2.44	0.244	0.773
	Bayou d'Inde	0.13	0.063	0.63	0.199	2.13	0.213	0.673
	Middle Calcasieu River	0.16	0.063	0.63	0.199	2.52	0.252	0.798
	Reference Areas	0.09	0.063	0.63	0.199	1.50	0.150	0.474
Lead	Upper Calcasieu River	3.36	2	20	6.32	1.68	0.168	0.530
	Bayou d'Inde	1.05	2	20	6.32	0.523	0.052	0.165
	Middle Calcasieu River	0.36	2	20	6.32	0.181	0.018	0.057
	Reference Areas	0.21	2	20	6.32	0.105	0.011	0.033
Lindane (gamma-HCH)	Upper Calcasieu River	0.01	0.77	1.2	0.961	0.013	0.008	0.010
	Bayou d'Inde	0.01	0.77	1.2	0.961	0.013	0.008	0.010
	Middle Calcasieu River	0.01	0.77	1.2	0.961	0.013	0.008	0.010
	Reference Areas	0.01	0.77	1.2	0.961	0.013	0.008	0.010

Table G-9. Calculated risk quotients (RQs) for COPCs for carnivorous fish in the Calcasieu River Estuary.

Chemical of Potential Concern	Area	Black Drum Whole Body Burden (mg/kg)	Fish NOAEL Tissue Residue Value (mg/kg)	Fish LOAEL Tissue Residue Value (mg/kg)	Fish ChV Tissue Residue Value (mg/kg)	RQ$_{NOAEL}$	RQ$_{LOAEL}$	RQ$_{ChV}$
Mercury	Upper Calcasieu River	0.14	2.28	22.8	7.210	0.060	0.006	0.019
	Bayou d'Inde	0.31	2.28	22.8	7.210	0.135	0.014	0.043
	Middle Calcasieu River	0.18	2.28	22.8	7.210	0.078	0.008	0.025
	Reference Areas	0.10	2.28	22.8	7.210	0.042	0.004	0.013
Selenium	Upper Calcasieu River	0.71	0.5	1.9	0.975	1.4	0.4	0.7
	Bayou d'Inde	0.66	0.5	1.9	0.975	1.3	0.3	0.7
	Middle Calcasieu River	0.98	0.5	1.9	0.975	2.0	0.5	1.0
	Reference Areas	0.76	0.5	1.9	0.975	1.5	0.4	0.8
2,3,7,8-TCDD-TEQs (Fish)	Upper Calcasieu River	0.00001	0.0001	0.001	0.0004	0.065	0.007	0.021
	Bayou d'Inde	0.00003	0.0001	0.001	0.0004	0.216	0.022	0.068
	Middle Calcasieu River	NA	0.0001	0.001	0.0004	NC	NC	NC
	Reference Areas	0.000002	0.0001	0.001	0.0004	0.015	0.002	0.005
Total PCBs	Upper Calcasieu River	0.589	0.153	1.53	0.484	3.85	0.385	1.22
	Bayou d'Inde	1.26	0.153	1.53	0.484	8.23	0.823	2.60
	Middle Calcasieu River	0.484	0.153	1.53	0.484	3.16	0.316	1.0
	Reference Areas	0.060	0.153	1.53	0.484	0.392	0.039	0.124

Note: Fish tissue values for aldrin, phthalates, and lead were extrapolated from AWQC (mg/L) by multiplying criterion by a BCF (L/kg)

NA = Not available; NC = Not calculated; PAHs = Polycyclic aromatic hydrocarbons (represented by Benzo(a)pyrene);
NOAEL = No observed adverse effect level; LOAEL = Lowest observed adverse effect level; ChV = geometric mean of NOAEL and LOAEL;

Table G-10. Calculated risk quotients (RQs) for COPCs for sediment-probing birds in the Calcasieu River Estuary.

Chemicals of Potential Concern	Area	Spotted Sandpiper TDI (mg/kg bw/day)	Estimated Wildlife TRV$_{NOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{LOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{ChV}$ (mg/kg bw/day)	RQ$_{NOAEL}$	RQ$_{LOAEL}$	RQ$_{ChV}$
Aldrin	Upper Calcasieu River	0.021	NA	NA	NC	NC	NC	NC
	Bayou d'Inde	0.023	NA	NA	NC	NC	NC	NC
	Middle Calcasieu River	0.012	NA	NA	NC	NC	NC	NC
	Reference Area	0.022	NA	NA	NC	NC	NC	NC
Total PCB	Upper Calcasieu River	0.161	0.18	1.8	0.569	0.893	0.089	0.282
	Bayou d'Inde	0.411	0.18	1.8	0.569	2.3	0.228	0.722
	Middle Calcasieu River	0.076	0.18	1.8	0.569	0.423	0.042	0.134
	Reference Area	0.116	0.18	1.8	0.569	0.646	0.065	0.204
PAHs	Upper Calcasieu River	0.462	NA	NA	NC	NC	NC	NC
	Bayou d'Inde	0.600	NA	NA	NC	NC	NC	NC
	Middle Calcasieu River	0.253	NA	NA	NC	NC	NC	NC
	Reference Area	0.057	NA	NA	NC	NC	NC	NC
Cadmium	Upper Calcasieu River	0.140	1.45	20	5.3852	0.097	0.007	0.026
	Bayou d'Inde	1.36	1.45	20	5.3852	0.938	0.068	0.253
	Middle Calcasieu River	1.17	1.45	20	5.3852	0.808	0.059	0.218
	Reference Area	0.365	1.45	20	5.3852	0.252	0.018	0.068
DDT and Metabolites	Upper Calcasieu River	0.101	0.003	0.028	0.009	35.9	3.6	11.4
	Bayou d'Inde	0.101	0.003	0.028	0.009	36.1	3.6	11.4
	Middle Calcasieu River	0.101	0.003	0.028	0.009	36.0	3.6	11.4
	Reference Area	0.101	0.003	0.028	0.009	36.0	3.6	11.4
Dieldrin	Upper Calcasieu River	0.021	0.077	NC	NC	0.273	NC	NC
	Bayou d'Inde	0.022	0.077	NC	NC	0.286	NC	NC
	Middle Calcasieu River	0.041	0.077	NC	NC	0.532	NC	NC
	Reference Area	0.022	0.077	NC	NC	0.286	NC	NC

Table G-10. Calculated risk quotients (RQs) for COPCs for sediment-probing birds in the Calcasieu River Estuary.

Chemicals of Potential Concern	Area	Spotted Sandpiper TDI (mg/kg bw/day)	Estimated Wildlife TRV$_{NOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{LOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{ChV}$ (mg/kg bw/day)	RQ$_{NOAEL}$	RQ$_{LOAEL}$	RQ$_{ChV}$
Di-n-butylphthalate	Upper Calcasieu River	0.477	0.11	1.1	0.348	4.3	0.433	1.4
	Bayou d'Inde	0.512	0.11	1.1	0.348	4.7	0.465	1.5
	Middle Calcasieu River	0.471	0.11	1.1	0.348	4.3	0.428	1.4
	Reference Area	0.302	0.11	1.1	0.348	2.7	0.275	0.9
alpha-HCH	Upper Calcasieu River	0.101	0.56	2.25	1.12	0.180	0.045	0.090
	Bayou d'Inde	0.101	0.56	2.25	1.12	0.180	0.045	0.090
	Middle Calcasieu River	0.101	0.56	2.25	1.12	0.180	0.045	0.090
	Reference Area	0.100	0.56	2.25	1.12	0.179	0.044	0.089
beta-HCH	Upper Calcasieu River	0.101	0.56	2.25	1.12	0.180	0.045	0.090
	Bayou d'Inde	0.107	0.56	2.25	1.12	0.191	0.048	0.095
	Middle Calcasieu River	0.101	0.56	2.25	1.12	0.180	0.045	0.090
	Reference Area	0.101	0.56	2.25	1.12	0.180	0.045	0.090
delta-HCH	Upper Calcasieu River	0.100	0.56	2.25	1.12	0.179	0.044	0.089
	Bayou d'Inde	0.101	0.56	2.25	1.12	0.180	0.045	0.090
	Middle Calcasieu River	0.101	0.56	2.25	1.12	0.180	0.045	0.090
	Reference Area	0.101	0.56	2.25	1.12	0.180	0.045	0.090
Hexachlorobenzene	Upper Calcasieu River	0.157	0.15	1.5	0.474	1.0	0.105	0.331
	Bayou d'Inde	0.170	0.15	1.5	0.474	1.1	0.113	0.359
	Middle Calcasieu River	0.182	0.15	1.5	0.474	1.2	0.122	0.384
	Reference Area	0.088	0.15	1.5	0.474	0.6	0.059	0.186
Hexachlorobutadiene	Upper Calcasieu River	4.04	NA	NA	NC	NC	NC	NC
	Bayou d'Inde	4.18	NA	NA	NC	NC	NC	NC
	Middle Calcasieu River	4.12	NA	NA	NC	NC	NC	NC
	Reference Area	4.01	NA	NA	NC	NC	NC	NC

Table G-10. Calculated risk quotients (RQs) for COPCs for sediment-probing birds in the Calcasieu River Estuary.

Chemicals of Potential Concern	Area	Spotted Sandpiper TDI (mg/kg bw/day)	Estimated Wildlife TRV$_{NOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{LOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{ChV}$ (mg/kg bw/day)	RQ$_{NOAEL}$	RQ$_{LOAEL}$	RQ$_{ChV}$
Lead	Upper Calcasieu River	14.2	1.1	11.3	3.53	12.9	1.3	4.04
	Bayou d'Inde	20.9	1.1	11.3	3.53	19	1.85	5.92
	Middle Calcasieu River	8.23	1.1	11.3	3.53	7.48	0.728	2.33
	Reference Area	5.93	1.1	11.3	3.53	5.39	0.524	1.68
Lindane (gamma-HCH)	Upper Calcasieu River	0.021	2	20	6.32	0.011	0.001	0.003
	Bayou d'Inde	0.022	2	20	6.32	0.011	0.001	0.003
	Middle Calcasieu River	0.041	2	20	6.32	0.021	0.002	0.006
	Reference Area	0.042	2	20	6.32	0.021	0.002	0.007
Mercury	Upper Calcasieu River	0.220	0.006	0.064	0.020	34	3	11
	Bayou d'Inde	0.180	0.006	0.064	0.020	28	3	9
	Middle Calcasieu River	0.200	0.006	0.064	0.020	31	3	10
	Reference Area	0.100	0.006	0.064	0.020	16	2	5
Selenium	Upper Calcasieu River	1.95	0.5	1	0.707	3.90	1.95	2.76
	Bayou d'Inde	1.62	0.5	1	0.707	3.25	1.62	2.29
	Middle Calcasieu River	2.63	0.5	1	0.707	5.27	2.63	3.73
	Reference Area	1.47	0.5	1	0.707	2.95	1.47	2.08
2,3,7,8-TCDD-TEQs (Avian)	Upper Calcasieu River	0.00009	0.00001	0.00014	0.00004	6.2	0.615	1.9
	Bayou d'Inde	0.0004	0.00001	0.00014	0.00004	28	2.8	8.9
	Middle Calcasieu River	0.00004	0.00001	0.00014	0.00004	2.8	0.282	0.892
	Reference Area	0.000003	0.00001	0.00014	0.00004	0.200	0.020	0.063

NA = Not available; NC = Not calculated; PAH = Polycyclic aromatic hydrocarbon (represented by Benzo(a)pyrene);

NOAEL - No observed adverse effect level; LOAEL - Lowest observed adverse effect level; ChV = geometric mean of NOAEL and LOAEL;

TRV = toxicity reference value; TDI = total daily intake.

Table G-11. Calculated risk quotients (RQs) for COPCs for carnivorous-wading birds in the Calcasieu River Estuary.

Chemicals of Potential Concern	Area	Great Egret TDI (mg/kg bw/day)	Estimated Wildlife TRV$_{NOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{LOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{ChV}$ (mg/kg bw/day)	RQ$_{NOAEL}$	RQ$_{LOAEL}$	RQ$_{ChV}$
Aldrin	Upper Calcasieu River	0.007	NA	NA	NC	NC	NC	NC
	Bayou d'Inde	0.007	NA	NA	NC	NC	NC	NC
	Middle Calcasieu River	0.007	NA	NA	NC	NC	NC	NC
	Reference Areas	0.007	NA	NA	NC	NC	NC	NC
PAHs	Upper Calcasieu River	0.157	NA	NA	NC	NC	NC	NC
	Bayou d'Inde	0.131	NA	NA	NC	NC	NC	NC
	Middle Calcasieu River	0.212	NA	NA	NC	NC	NC	NC
	Reference Areas	0.261	NA	NA	NC	NC	NC	NC
Cadmium	Upper Calcasieu River	0.007	1.45	20	5.39	0.004	0.0003	0.269
	Bayou d'Inde	0.007	1.45	20	5.39	0.004	0.0003	0.269
	Middle Calcasieu River	0.002	1.45	20	5.39	0.001	0.0001	0.269
	Reference Areas	0.006	1.45	20	5.39	0.004	0.0003	0.269
DDT and Metabolites	Upper Calcasieu River	0.007	0.0028	0.028	0.009	2.33	0.233	0.316
	Bayou d'Inde	0.007	0.0028	0.028	0.009	2.33	0.233	0.316
	Middle Calcasieu River	0.007	0.0028	0.028	0.009	2.33	0.233	0.316
	Reference Areas	0.007	0.0028	0.028	0.009	2.33	0.233	0.316
Dieldrin	Upper Calcasieu River	0.007	0.077	NA	NC	0.085	NC	NC
	Bayou d'Inde	0.007	0.077	NA	NC	0.085	NC	NC
	Middle Calcasieu River	0.007	0.077	NA	NC	0.085	NC	NC
	Reference Areas	0.007	0.077	NA	NC	0.085	NC	NC
Di-n-butylphthalate	Upper Calcasieu River	0.089	0.11	1.1	0.348	0.806	0.081	0.255
	Bayou d'Inde	0.131	0.11	1.1	0.348	1.19	0.119	0.375
	Middle Calcasieu River	0.131	0.11	1.1	0.348	1.19	0.119	0.375
	Reference Areas	0.127	0.11	1.1	0.348	1.15	0.115	0.364

Table G-11. Calculated risk quotients (RQs) for COPCs for carnivorous-wading birds in the Calcasieu River Estuary.

Chemicals of Potential Concern	Area	Great Egret TDI (mg/kg bw/day)	Estimated Wildlife TRV$_{NOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{LOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{ChV}$ (mg/kg bw/day)	RQ$_{NOAEL}$	RQ$_{LOAEL}$	RQ$_{ChV}$
alpha-HCH	Upper Calcasieu River	0.003	0.56	2.25	1.12	0.005	0.001	0.499
	Bayou d'Inde	0.003	0.56	2.25	1.12	0.005	0.001	0.499
	Middle Calcasieu River	0.003	0.56	2.25	1.12	0.005	0.001	0.499
	Reference Areas	0.003	0.56	2.25	1.12	0.005	0.001	0.499
beta-HCH	Upper Calcasieu River	0.003	0.56	2.25	1.12	0.005	0.001	0.499
	Bayou d'Inde	0.008	0.56	2.25	1.12	0.014	0.004	0.499
	Middle Calcasieu River	0.003	0.56	2.25	1.12	0.005	0.001	0.499
	Reference Areas	0.003	0.56	2.25	1.12	0.005	0.001	0.499
delta-HCH	Upper Calcasieu River	0.003	0.56	2.25	1.12	0.005	0.001	0.499
	Bayou d'Inde	0.003	0.56	2.25	1.12	0.005	0.001	0.499
	Middle Calcasieu River	0.003	0.56	2.25	1.12	0.005	0.001	0.499
	Reference Areas	0.003	0.56	2.25	1.12	0.005	0.001	0.499
Hexachlorobenzene	Upper Calcasieu River	0.147	0.15	1.5	0.47	0.980	0.098	0.316
	Bayou d'Inde	0.130	0.15	1.5	0.47	0.867	0.087	0.316
	Middle Calcasieu River	0.209	0.15	1.5	0.47	1.39	0.139	0.316
	Reference Areas	0.263	0.15	1.5	0.47	1.753	0.175	0.316
Hexachlorobutadiene	Upper Calcasieu River	0.320	NA	NA	NC	NC	NC	NC
	Bayou d'Inde	0.261	NA	NA	NC	NC	NC	NC
	Middle Calcasieu River	0.391	NA	NA	NC	NC	NC	NC
	Reference Areas	0.496	NA	NA	NC	NC	NC	NC
Lead	Upper Calcasieu River	0.337	1.1	11.3	3.53	0.307	0.030	0.096
	Bayou d'Inde	0.718	1.1	11.3	3.53	0.652	0.063	0.204
	Middle Calcasieu River	0.369	1.1	11.3	3.53	0.336	0.033	0.105
	Reference Areas	0.114	1.1	11.3	3.53	0.104	0.010	0.032

Table G-11. Calculated risk quotients (RQs) for COPCs for carnivorous-wading birds in the Calcasieu River Estuary.

Chemicals of Potential Concern	Area	Great Egret TDI (mg/kg bw/day)	Estimated Wildlife TRV$_{NOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{LOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{ChV}$ (mg/kg bw/day)	RQ$_{NOAEL}$	RQ$_{LOAEL}$	RQ$_{ChV}$
Lindane (gamma-HCH)	Upper Calcasieu River	0.007	2	20	6.32	0.003	0.0003	0.001
	Bayou d'Inde	0.007	2	20	6.32	0.003	0.0003	0.001
	Middle Calcasieu River	0.007	2	20	6.32	0.003	0.0003	0.001
	Reference Areas	0.007	2	20	6.32	0.003	0.0003	0.001
Mercury	Upper Calcasieu River	0.071	0.0064	0.064	0.020	11.1	1.1	3.5
	Bayou d'Inde	0.329	0.0064	0.064	0.020	51.5	5.1	16.3
	Middle Calcasieu River	0.076	0.0064	0.064	0.020	11.8	1.2	3.7
	Reference Areas	0.030	0.0064	0.064	0.020	4.7	0.5	1.5
Selenium	Upper Calcasieu River	0.340	0.5	1	0.707	0.7	0.3	0.5
	Bayou d'Inde	0.493	0.5	1	0.707	1.0	0.5	0.7
	Middle Calcasieu River	0.374	0.5	1	0.707	0.7	0.4	0.5
	Reference Areas	0.245	0.5	1	0.707	0.5	0.2	0.3
2,3,7,8-TCDD-TEQs (Avian)	Upper Calcasieu River	0.000007	0.00001	0.0001	0.0000443	0.5	0.1	0.2
	Bayou d'Inde	0.00004	0.00001	0.0001	0.0000443	3.1	0.3	1.0
	Middle Calcasieu River	0.00004	0.00001	0.0001	0.0000443	2.9	0.3	0.9
	Reference Areas	0.00002	0.00001	0.0001	0.0000443	1.4	0.1	0.4
Total PCBs	Upper Calcasieu River	0.012	0.18	1.8	0.569	0.1	0.007	0.022
	Bayou d'Inde	0.337	0.18	1.8	0.569	1.9	0.2	0.6
	Middle Calcasieu River	0.046	0.18	1.8	0.569	0.3	0.026	0.081
	Reference Areas	0.189	0.18	1.8	0.569	1.1	0.1	0.3

NA = Not available; NC = Not calculated; PAHs = Polycyclic aromatic hydrocarbons (represented by Benzo(a)pyrene)

NOAEL = No observed adverse effect level; LOAEL = Lowest observed adverse effect level; ChV = geometric mean of NOAEL and LOAEL;

TRV = toxicity reference value; TDI = total daily intake

Table G-12. Calculated risk quotients (RQs) for COPCs for omnivorous mammals in the Calcasieu River Estuary.

Chemical of Potential Concern	Area	Raccoon TDI (mg/kg bw/day)	Estimated Wildlife TRV$_{NOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{LOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{ChV}$ (mg/kg bw/day)	RQ$_{NOAEL}$	RQ$_{LOAEL}$	RQ$_{ChV}$
Aldrin	Upper Calcasieu River	0.002	0.024	0.121	0.054	0.100	0.020	0.045
	Bayou d'Inde	0.002	0.024	0.121	0.054	0.100	0.020	0.045
	Middle Calcasieu River	0.002	0.024	0.121	0.054	0.100	0.020	0.045
	Reference Areas	0.002	0.024	0.121	0.054	0.100	0.020	0.045
PAHs	Upper Calcasieu River	0.120	0.010	0.103	0.033	11.6	1.2	3.7
	Bayou d'Inde	0.097	0.010	0.103	0.033	9.3	0.9	3.0
	Middle Calcasieu River	0.145	0.010	0.103	0.033	14.0	1.4	4.4
	Reference Areas	0.184	0.010	0.103	0.033	17.8	1.8	5.6
Cadmium	Upper Calcasieu River	0.002	0.121	1.21	0.382	0.020	0.002	0.006
	Bayou d'Inde	0.002	0.121	1.21	0.382	0.020	0.002	0.006
	Middle Calcasieu River	0.001	0.121	1.21	0.382	0.006	0.001	0.002
	Reference Areas	0.002	0.121	1.21	0.382	0.018	0.002	0.006
DDT and Metabolites	Upper Calcasieu River	0.002	0.008	0.041	0.019	0.292	0.058	0.131
	Bayou d'Inde	0.002	0.008	0.041	0.019	0.292	0.058	0.131
	Middle Calcasieu River	0.002	0.008	0.041	0.019	0.292	0.058	0.131
	Reference Areas	0.002	0.008	0.041	0.019	0.292	0.058	0.131
Dieldrin	Upper Calcasieu River	0.002	0.002	0.024	0.008	1.0	0.100	0.317
	Bayou d'Inde	0.002	0.002	0.024	0.008	1.0	0.100	0.317
	Middle Calcasieu River	0.002	0.002	0.024	0.008	1.0	0.100	0.317
	Reference Areas	0.002	0.002	0.024	0.008	1.0	0.100	0.317
Di-n-butylphthalate	Upper Calcasieu River	0.118	5.69	19.0	10.4	0.021	0.006	0.011
	Bayou d'Inde	1.21	5.69	19.0	10.4	0.212	0.064	0.116
	Middle Calcasieu River	1.76	5.69	19.0	10.4	0.310	0.093	0.170
	Reference Areas	0.471	5.69	19.0	10.4	0.083	0.025	0.045

Table G-12. Calculated risk quotients (RQs) for COPCs for omnivorous mammals in the Calcasieu River Estuary.

Chemical of Potential Concern	Area	Raccoon TDI (mg/kg bw/day)	Estimated Wildlife TRV_{NOAEL} (mg/kg/day)	Estimated Wildlife TRV_{LOAEL} (mg/kg/day)	Estimated Wildlife TRV_{ChV} (mg/kg bw/day)	RQ_{NOAEL}	RQ_{LOAEL}	RQ_{ChV}
alpha-HCH	Upper Calcasieu River	0.001	0.005	0.048	0.015	0.207	0.021	0.066
	Bayou d'Inde	0.001	0.005	0.048	0.015	0.207	0.021	0.066
	Middle Calcasieu River	0.001	0.005	0.048	0.015	0.207	0.021	0.066
	Reference Areas	0.001	0.005	0.048	0.015	0.207	0.021	0.066
beta-HCH	Upper Calcasieu River	0.001	0.005	0.048	0.015	0.207	0.021	0.066
	Bayou d'Inde	0.003	0.005	0.048	0.015	0.621	0.062	0.197
	Middle Calcasieu River	0.001	0.005	0.048	0.015	0.207	0.021	0.066
	Reference Areas	0.001	0.005	0.048	0.015	0.207	0.021	0.066
delta-HCH	Upper Calcasieu River	0.001	0.005	0.048	0.015	0.207	0.021	0.066
	Bayou d'Inde	0.001	0.005	0.048	0.015	0.207	0.021	0.066
	Middle Calcasieu River	0.001	0.005	0.048	0.015	0.207	0.021	0.066
	Reference Areas	0.001	0.005	0.048	0.015	0.207	0.021	0.066
Hexachlorobenzene	Upper Calcasieu River	0.054	0.007	0.072	0.023	7.51	0.751	2.38
	Bayou d'Inde	0.048	0.007	0.072	0.023	6.68	0.668	2.11
	Middle Calcasieu River	0.077	0.007	0.072	0.023	10.7	1.07	3.38
	Reference Areas	0.097	0.007	0.072	0.023	13.4	1.34	4.22
Hexachlorobutadiene	Upper Calcasieu River	0.118	0.024	0.241	0.076	4.91	0.491	1.55
	Bayou d'Inde	0.097	0.024	0.241	0.076	4.01	0.401	1.27
	Middle Calcasieu River	0.145	0.024	0.241	0.076	6.01	0.601	1.90
	Reference Areas	0.184	0.024	0.241	0.076	7.61	0.761	2.41
Lead	Upper Calcasieu River	0.127	0.966	9.655	3.053	0.131	0.013	0.042
	Bayou d'Inde	0.278	0.966	9.655	3.053	0.288	0.029	0.091
	Middle Calcasieu River	0.142	0.966	9.655	3.053	0.147	0.015	0.046
	Reference Areas	0.016	0.966	9.655	3.053	0.017	0.002	0.005

Table G-12. Calculated risk quotients (RQs) for COPCs for omnivorous mammals in the Calcasieu River Estuary.

Chemical of Potential Concern	Area	Raccoon TDI (mg/kg bw/day)	Estimated Wildlife TRV_{NOAEL} (mg/kg/day)	Estimated Wildlife TRV_{LOAEL} (mg/kg/day)	Estimated Wildlife TRV_{ChV} (mg/kg bw/day)	RQ_{NOAEL}	RQ_{LOAEL}	RQ_{ChV}
Lindane (gamma-HCH)	Upper Calcasieu River	0.002	0.966	NA	NA	0.003	NC	NC
	Bayou d'Inde	0.002	0.966	NA	NA	0.003	NC	NC
	Middle Calcasieu River	0.002	0.966	NA	NA	0.003	NC	NC
	Reference Areas	0.002	0.966	NA	NA	0.003	NC	NC
Mercury	Upper Calcasieu River	0.004	0.009	0.015	0.012	0.411	0.247	0.318
	Bayou d'Inde	0.017	0.009	0.015	0.012	1.9	1.1	1.5
	Middle Calcasieu River	0.004	0.009	0.015	0.012	0.433	0.260	0.336
	Reference Areas	0.002	0.009	0.015	0.012	0.178	0.107	0.138
Selenium	Upper Calcasieu River	0.126	0.090	0.151	0.117	1.40	0.834	1.08
	Bayou d'Inde	0.183	0.090	0.151	0.117	2.03	1.21	1.57
	Middle Calcasieu River	0.139	0.090	0.151	0.117	1.54	0.919	1.19
	Reference Areas	0.091	0.090	0.151	0.117	1.01	0.602	0.780
2,3,7,8-TCDD-TEQs (Mammalian)	Upper Calcasieu River	0.00000190	0.000000121	0.00000121	0.000000382	15.7	1.57	4.97
	Bayou d'Inde	0.00000673	0.000000121	0.00000121	0.000000382	55.8	5.58	17.6
	Middle Calcasieu River	0.00000556	0.000000121	0.00000121	0.000000382	46.1	4.6	14.6
	Reference Areas	0.00000240	0.000000121	0.00000121	0.000000382	19.9	1.99	6.3
Total PCBs	Upper Calcasieu River	0.005	0.083	0.410	0.003	0.055	0.011	1.691
	Bayou d'Inde	0.125	0.083	0.410	0.003	1.50	0.304	45.846
	Middle Calcasieu River	0.017	0.083	0.410	0.003	0.207	0.042	6.324
	Reference Areas	0.070	0.083	0.410	0.003	0.845	0.171	25.772

NA = Not available; NC = Not calculated; PAHs = Polycyclic aromatic hydrocarbons (represented by Benzo(a)pyrene);

NOAEL = No observed adverse effect level; LOAEL = Lowest observed adverse effect level; ChV = geometric mean of NOAEL and LOAEL;

TRV = toxicity reference value; TDI = total daily intake.

Table G-13. Calculated risk quotients (RQs) for COPCs for piscivorus birds in the Calcasieu River Estuary.

Chemical of Potential Concern	Area	Belted kingfisher TDI (mg/kg bw/day)	Estimated Wildlife TRV$_{NOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{LOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{ChV}$ (mg/kg bw/day)	RQ$_{NOAEL}$	RQ$_{LOAEL}$	RQ$_{ChV}$
Aldrin	Upper Calcasieu River	0.006	NA	NA	NC	NC	NC	NC
	Bayou d'Inde	0.006	NA	NA	NC	NC	NC	NC
	Middle Calcasieu River	0.006	NA	NA	NC	NC	NC	NC
	Reference Areas	0.006	NA	NA	NC	NC	NC	NC
PAHs	Upper Calcasieu River	0.273	NA	NA	NC	NC	NC	NC
	Bayou d'Inde	0.228	NA	NA	NC	NC	NC	NC
	Middle Calcasieu River	0.370	NA	NA	NC	NC	NC	NC
	Reference Areas	0.456	NA	NA	NC	NC	NC	NC
Cadmium	Upper Calcasieu River	0.011	1.45	20	5.39	0.008	0.001	0.002
	Bayou d'Inde	0.011	1.45	20	5.39	0.008	0.001	0.002
	Middle Calcasieu River	0.003	1.45	20	5.39	0.002	0.000	0.001
	Reference Areas	0.010	1.45	20	5.39	0.007	0.001	0.002
DDT and Metabolites	Upper Calcasieu River	0.011	0.003	0.028	0.009	4.07	0.407	1.29
	Bayou d'Inde	0.011	0.003	0.028	0.009	4.07	0.407	1.29
	Middle Calcasieu River	0.011	0.003	0.028	0.009	4.07	0.407	1.29
	Reference Areas	0.011	0.003	0.028	0.009	4.07	0.407	1.29
Dieldrin	Upper Calcasieu River	0.011	0.077	NA	NC	0.148	NC	NC
	Bayou d'Inde	0.011	0.077	NA	NC	0.148	NC	NC
	Middle Calcasieu River	0.011	0.077	NA	NC	0.148	NC	NC
	Reference Areas	0.011	0.077	NA	NC	0.148	NC	NC
Di-n-butylphthalate	Upper Calcasieu River	0.155	0.110	1.1	0.348	1.41	0.141	0.445
	Bayou d'Inde	0.228	0.110	1.1	0.348	2.07	0.207	0.655
	Middle Calcasieu River	0.228	0.110	1.1	0.348	2.07	0.207	0.655
	Reference Areas	0.221	0.110	1.1	0.348	2.01	0.201	0.635

Table G-13. Calculated risk quotients (RQs) for COPCs for piscivorus birds in the Calcasieu River Estuary.

Chemical of Potential Concern	Area	Belted kingfisher TDI (mg/kg bw/day)	Estimated Wildlife TRV$_{NOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{LOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{ChV}$ (mg/kg bw/day)	RQ$_{NOAEL}$	RQ$_{LOAEL}$	RQ$_{ChV}$
alpha-HCH	Upper Calcasieu River	0.057	0.560	2.25	1.12	0.102	0.025	0.051
	Bayou d'Inde	0.057	0.560	2.25	1.12	0.102	0.025	0.051
	Middle Calcasieu River	0.057	0.560	2.25	1.12	0.102	0.025	0.051
	Reference Areas	0.057	0.560	2.25	1.12	0.102	0.025	0.051
beta-HCH	Upper Calcasieu River	0.057	0.560	2.25	1.12	0.102	0.025	0.051
	Bayou d'Inde	0.014	0.560	2.25	1.12	0.024	0.006	0.012
	Middle Calcasieu River	0.057	0.560	2.25	1.12	0.102	0.025	0.051
	Reference Areas	0.057	0.560	2.25	1.12	0.102	0.025	0.051
Hexachlorobenzene	Upper Calcasieu River	0.256	0.150	1.5	0.474	1.71	0.171	0.540
	Bayou d'Inde	0.228	0.150	1.5	0.474	1.52	0.152	0.480
	Middle Calcasieu River	0.364	0.150	1.5	0.474	2.43	0.243	0.768
	Reference Areas	0.114	0.150	1.5	0.474	0.759	0.076	0.240
Hexachlorobutadiene	Upper Calcasieu River	0.256	NA	NA	NC	NC	NC	NC
	Bayou d'Inde	0.228	NA	NA	NC	NC	NC	NC
	Middle Calcasieu River	0.364	NA	NA	NC	NC	NC	NC
	Reference Areas	0.456	NA	NA	NC	NC	NC	NC
Lead	Upper Calcasieu River	0.589	1.1	11.3	3.53	0.535	0.052	0.167
	Bayou d'Inde	1.25	1.1	11.3	3.53	1.14	0.111	0.355
	Middle Calcasieu River	0.645	1.1	11.3	3.53	0.586	0.057	0.183
	Reference Areas	0.200	1.1	11.3	3.53	0.182	0.018	0.057
Lindane (gamma-HCH)	Upper Calcasieu River	0.011	2	20	6.32	0.006	0.001	0.002
	Bayou d'Inde	0.011	2	20	6.32	0.006	0.001	0.002
	Middle Calcasieu River	0.011	2	20	6.32	0.006	0.001	0.002
	Reference Areas	0.011	2	20	6.32	0.006	0.001	0.002

Table G-13. Calculated risk quotients (RQs) for COPCs for piscivorus birds in the Calcasieu River Estuary.

Chemical of Potential Concern	Area	Belted kingfisher TDI (mg/kg bw/day)	Estimated Wildlife TRV_{NOAEL} (mg/kg/day)	Estimated Wildlife TRV_{LOAEL} (mg/kg/day)	Estimated Wildlife TRV_{ChV} (mg/kg bw/day)	RQ_{NOAEL}	RQ_{LOAEL}	RQ_{ChV}
Mercury	Upper Calcasieu River	0.124	0.006	0.064	0.020	19.4	1.94	6.13
	Bayou d'Inde	0.575	0.006	0.064	0.020	89.8	8.98	28.4
	Middle Calcasieu River	0.132	0.006	0.064	0.020	20.6	2.1	6.53
	Reference Areas	0.052	0.006	0.064	0.020	8.19	0.819	2.59
Selenium	Upper Calcasieu River	0.593	0.500	1	0.707	1.19	0.593	0.839
	Bayou d'Inde	0.861	0.500	1	0.707	1.72	0.861	1.22
	Middle Calcasieu River	0.654	0.500	1	0.707	1.31	0.654	0.924
	Reference Areas	0.428	0.500	1	0.707	0.856	0.428	0.605
2,3,7,8-TCDD-TEQs (Avian)	Upper Calcasieu River	0.00001	0.00001	0.0001	0.0000443	0.879	0.088	0.278
	Bayou d'Inde	0.00008	0.00001	0.0001	0.0000443	5.46	0.546	1.73
	Middle Calcasieu River	0.00007	0.00001	0.0001	0.0000443	4.79	0.479	1.52
	Reference Areas	0.00003	0.00001	0.0001	0.0000443	2.38	0.238	0.752
Total PCBs	Upper Calcasieu River	0.022	0.180	1.8	0.569	0.120	0.012	0.038
	Bayou d'Inde	0.588	0.180	1.8	0.569	3.26	0.326	1.03
	Middle Calcasieu River	0.081	0.180	1.8	0.569	0.449	0.045	0.142
	Reference Areas	0.330	0.180	1.8	0.569	1.83	0.183	0.580

NA = Not available; NC = Not calculated; PAHs = Polycyclic aromatic hydrocarbons (represented by Benzo(a)pyrene);

NOAEL = No observed adverse effect level; LOAEL = Lowest observed adverse effect level; ChV = geometric mean of NOAEL and LOAEL;

TRV = toxicity reference value; TDI = total daily intake.

Table G-14. Calculated risk quotients (RQs) for COPCs for piscivorus mammals in the Calcasieu River Estuary.

Chemical of Potential Concern	Area	River Otter TDI (mg/kg bw/day)	Estimated Wildlife TRV$_{NOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{LOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{ChV}$ (mg/kg bw/day)	RQ$_{NOAEL}$	RQ$_{LOAEL}$	RQ$_{ChV}$
Aldrin	Upper Calcasieu River	0.004	0.007	0.034	0.015	0.624	0.125	0.279
	Bayou d'Inde	0.019	0.007	0.034	0.015	2.823	0.565	1.26
	Middle Calcasieu River	0.004	0.007	0.034	0.015	0.624	0.125	0.279
	Reference Areas	0.004	0.007	0.034	0.015	0.535	0.107	0.239
PAHs	Upper Calcasieu River	0.042	0.250	2.47	0.786	0.170	0.017	0.054
	Bayou d'Inde	0.036	0.250	2.47	0.786	0.145	0.015	0.046
	Middle Calcasieu River	0.056	0.250	2.47	0.786	0.222	0.023	0.071
	Reference Areas	0.067	0.250	2.47	0.786	0.269	0.027	0.086
Cadmium	Upper Calcasieu River	0.004	0.034	0.337	0.106	0.107	0.011	0.034
	Bayou d'Inde	0.004	0.034	0.337	0.106	0.107	0.011	0.034
	Middle Calcasieu River	0.003	0.034	0.337	0.106	0.074	0.007	0.023
	Reference Areas	0.004	0.034	0.337	0.106	0.104	0.010	0.033
DDT and Metabolites	Upper Calcasieu River	0.004	0.002	0.012	0.005	1.91	0.381	0.853
	Bayou d'Inde	0.007	0.002	0.012	0.005	2.99	0.598	1.34
	Middle Calcasieu River	0.005	0.002	0.012	0.005	2.04	0.407	0.911
	Reference Areas	0.004	0.002	0.012	0.005	1.56	0.312	0.698
Dieldrin	Upper Calcasieu River	0.004	0.001	0.007	0.002	5.35	0.535	1.69
	Bayou d'Inde	0.005	0.001	0.007	0.002	7.58	0.758	2.40
	Middle Calcasieu River	0.004	0.001	0.007	0.002	6.24	0.624	1.97
	Reference Areas	0.004	0.001	0.007	0.002	5.35	0.535	1.69
Di-n-butylphthalate	Upper Calcasieu River	0.061	136	454	248	0.0004	0.0001	0.0002
	Bayou d'Inde	0.786	136	454	248	0.006	0.002	0.003
	Middle Calcasieu River	1.090	136	454	248	0.008	0.002	0.004
	Reference Areas	0.195	136	454	248	0.001	0.000	0.001

Table G-14. Calculated risk quotients (RQs) for COPCs for piscivorus mammals in the Calcasieu River Estuary.

Chemical of Potential Concern	Area	River Otter TDI (mg/kg bw/day)	Estimated Wildlife TRV$_{NOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{LOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{ChV}$ (mg/kg bw/day)	RQ$_{NOAEL}$	RQ$_{LOAEL}$	RQ$_{ChV}$
alpha-HCH	Upper Calcasieu River	0.002	0.001	0.013	0.004	1.3	0.1	0.4
	Bayou d'Inde	0.002	0.001	0.013	0.004	1.3	0.1	0.4
	Middle Calcasieu River	0.002	0.001	0.013	0.004	1.3	0.1	0.4
	Reference Areas	0.002	0.001	0.013	0.004	1.3	0.1	0.4
beta-HCH	Upper Calcasieu River	0.009	0.180	0.910	0.405	0.048	0.010	0.021
	Bayou d'Inde	0.036	0.180	0.910	0.405	0.200	0.040	0.089
	Middle Calcasieu River	0.006	0.180	0.910	0.405	0.035	0.007	0.016
	Reference Areas	0.002	0.180	0.910	0.405	0.010	0.002	0.004
Hexachlorobenzene	Upper Calcasieu River	0.040	0.002	0.020	0.006	19.9	1.99	6.28
	Bayou d'Inde	0.060	0.002	0.020	0.006	29.6	2.96	9.35
	Middle Calcasieu River	0.063	0.002	0.020	0.006	31.0	3.10	9.80
	Reference Areas	0.067	0.002	0.020	0.006	33.3	3.33	10.5
Hexachlorobutadiene	Upper Calcasieu River	0.067	0.007	0.067	0.021	9.92	0.992	3.14
	Bayou d'Inde	0.059	0.007	0.067	0.021	8.72	0.872	2.76
	Middle Calcasieu River	0.083	0.007	0.067	0.021	12.3	1.23	3.88
	Reference Areas	0.081	0.007	0.067	0.021	12.0	1.20	3.80
Lead	Upper Calcasieu River	0.774	3.66	36.6	11.6	0.212	0.021	0.067
	Bayou d'Inde	0.388	3.66	36.6	11.6	0.106	0.011	0.034
	Middle Calcasieu River	0.163	3.66	36.6	11.6	0.044	0.004	0.014
	Reference Areas	0.070	3.66	36.6	11.6	0.019	0.002	0.006
Lindane (gamma-HCH)	Upper Calcasieu River	0.004	0.269	NC	NC	0.013	NC	NC
	Bayou d'Inde	0.004	0.269	NC	NC	0.013	NC	NC
	Middle Calcasieu River	0.004	0.269	NC	NC	0.013	NC	NC
	Reference Areas	0.004	0.269	NC	NC	0.013	NC	NC

Table G-14. Calculated risk quotients (RQs) for COPCs for piscivorus mammals in the Calcasieu River Estuary.

Chemical of Potential Concern	Area	River Otter TDI (mg/kg bw/day)	Estimated Wildlife TRV$_{NOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{LOAEL}$ (mg/kg/day)	Estimated Wildlife TRV$_{ChV}$ (mg/kg bw/day)	RQ$_{NOAEL}$	RQ$_{LOAEL}$	RQ$_{ChV}$
Mercury	Upper Calcasieu River	0.038	0.009	0.015	0.012	4.24	2.55	3.29
	Bayou d'Inde	0.142	0.009	0.015	0.012	15.8	9.47	12.2
	Middle Calcasieu River	0.046	0.009	0.015	0.012	5.08	3.05	3.93
	Reference Areas	0.027	0.009	0.015	0.012	3.01	1.81	2.33
Selenium	Upper Calcasieu River	0.227	0.091	0.151	0.117	2.50	1.51	1.94
	Bayou d'Inde	0.254	0.091	0.151	0.117	2.79	1.68	2.17
	Middle Calcasieu River	0.293	0.091	0.151	0.117	3.22	1.94	2.50
	Reference Areas	0.216	0.091	0.151	0.117	2.37	1.43	1.84
2,3,7,8-TCDD-TEQs (Mammalian)	Upper Calcasieu River	0.0000113	0.000000500	0.00000460	0.00000152	22.7	2.47	7.48
	Bayou d'Inde	0.0000344	0.000000500	0.00000460	0.00000152	68.7	7.47	22.7
	Middle Calcasieu River	0.0000163	0.000000500	0.00000460	0.00000152	32.6	3.54	10.7
	Reference Areas	0.00000254	0.000000500	0.00000460	0.00000152	5.07	0.6	1.67
Total PCBs	Upper Calcasieu River	0.125	0.083	0.410	0.003	1.50	0.304	45.9
	Bayou d'Inde	0.340	0.083	0.410	0.003	4.10	0.830	125
	Middle Calcasieu River	0.111	0.083	0.410	0.003	1.34	0.271	40.8
	Reference Areas	0.136	0.083	0.410	0.003	1.63	0.330	49.8

NA = Not available; NC = Not calculated; PAHs = Polycyclic aromatic hydrocarbons (represented by Benzo(a)pyrene);

NOAEL = No observed adverse effect level; LOAEL = Lowest observed adverse effect level; ChV = geometric mean of NOAEL and LOAEL;

TRV = toxicity reference value; TDI = total daily intake.

Table G-15. Review and summary of risk quotient evaluations for all COPCs in all study areas.

Guild and Chemical of Potential Concern	Area	Hazard Quotient RQ	> 90% Non-Detects YES/NO	< 1.2x Reference Area YES/NO	Move to PRA YES/NO
Carnivorous Fish					
Di-n-butylphthalate	Upper Calcasieu River	0.9	YES	NA	ID
	Bayou d'Inde	2.3	YES	NA	ID
	Middle Calcasieu River	1.2	YES	NA	ID
	Reference Areas	2.1	YES	NA	ID
Total PCBs	Upper Calcasieu River	1.22	NO	NO	YES
	Bayou d'Inde	2.6	NO	NO	YES
	Middle Calcasieu River	1.0	NO	NO	YES
	Reference Areas	0.124	NO	NA	YES
Sediment-Probing Birds					
DDT and Metabolites	Upper Calcasieu River	11.4	YES	NA	ID
	Bayou d'Inde	11.4	YES	NA	ID
	Middle Calcasieu River	11.4	YES	NA	ID
	Reference Areas	11.4	YES	NA	ID
Di-n-butylphthalate	Upper Calcasieu River	1.4	YES	NA	ID
	Bayou d'Inde	1.5	YES	NA	ID
	Middle Calcasieu River	1.4	YES	NA	ID
	Reference Areas	0.9	YES	NA	ID
Lead	Upper Calcasieu River	4.0	NO	NO	YES
	Bayou d'Inde	5.92	NO	NO	YES
	Middle Calcasieu River	2.33	NO	NO	YES
	Reference Areas	1.68	NO	NA	YES

Table G-15. Review and summary of risk quotient evaluations for all COPCs in all study areas.

Guild and Chemical of Potential Concern	Area	Hazard Quotient RQ	> 90% Non-Detects YES/NO	< 1.2x Reference Area YES/NO	Move to PRA YES/NO
Sediment-Probing Birds (cont.)					
Mercury	Upper Calcasieu River	11	NO	NO	YES
	Bayou d'Inde	9	NO	NO	YES
	Middle Calcasieu River	10	NO	NO	YES
	Reference Areas	5	NO	NA	YES
Selenium	Upper Calcasieu River	2.76	NO	NO	YES
	Bayou d'Inde	2.29	NO	NO	YES
	Middle Calcasieu River	3.73	NO	NO	YES
	Reference Areas	2.08	NO	NA	YES
2,3,7,8-TCDD-TEQs	Upper Calcasieu River	1.9	NO	NO	YES
	Bayou d'Inde	8.9	NO	NO	YES
	Middle Calcasieu River	0.892	NO	NO	NO
	Reference Areas	0.063	NO	NA	YES
Carnivorous-Wading Birds					
Mercury	Upper Calcasieu River	3.5	NO	NO	YES
	Bayou d'Inde	16.3	NO	NO	YES
	Middle Calcasieu River	3.7	NO	NO	YES
	Reference Areas	1.5	NO	NA	YES
2,3,7,8-TCDD-TEQs	Upper Calcasieu River	0.2	NO	YES	NO
	Bayou d'Inde	1.0	NO	NO	YES
	Middle Calcasieu River	0.9	NO	NO	NO
	Reference Areas	0.4	NO	NA	YES

Table G-15. Review and summary of risk quotient evaluations for all COPCs in all study areas.

Guild and Chemical of Potential Concern	Area	Hazard Quotient RQ	> 90% Non-Detects YES/NO	< 1.2x Reference Area YES/NO	Move to PRA YES/NO
Omnivorous Mammals					
PAHs	Upper Calcasieu River	3.7	NO	YES	NO
	Bayou d'Inde	3.0	NO	YES	NO
	Middle Calcasieu River	4.4	NO	YES	NO
	Reference Areas	5.6	NO	NA	NO
Hexachlorobenzene	Upper Calcasieu River	2.38	NO	YES	NO
	Bayou d'Inde	2.11	NO	YES	NO
	Middle Calcasieu River	3.38	NO	YES	NO
	Reference Areas	4.22	NO	NA	NO
Hexachlorobutadiene	Upper Calcasieu River	1.55	NO	YES	NO
	Bayou d'Inde	1.27	NO	YES	NO
	Middle Calcasieu River	1.90	NO	YES	NO
	Reference Areas	2.41	NO	NA	NO
Mercury	Upper Calcasieu River	0.318	NO	NO	NO
	Bayou d'Inde	1.5	NO	NO	YES
	Middle Calcasieu River	0.336	NO	NO	NO
	Reference Areas	0.138	NO	NA	YES
Selenium	Upper Calcasieu River	1.08	NO	NO	YES
	Bayou d'Inde	1.57	NO	NO	YES
	Middle Calcasieu River	1.19	NO	NO	YES
	Reference Areas	0.78	NO	NA	YES
2,3,7,8-TCDD-TEQs	Upper Calcasieu River	4.97	NO	YES	NO
	Bayou d'Inde	17.6	NO	NO	YES
	Middle Calcasieu River	14.7	NO	NO	YES
	Reference Areas	6.29	NO	NA	YES

Table G-15. Review and summary of risk quotient evaluations for all COPCs in all study areas.

Guild and Chemical of Potential Concern	Area	Hazard Quotient RQ	> 90% Non-Detects YES/NO	< 1.2x Reference Area YES/NO	Move to PRA YES/NO
Omnivorous Mammals (cont.)					
Total PCBs	Upper Calcasieu River	1.691	NO	YES	NO
	Bayou d'Inde	45.846	NO	NO	YES
	Middle Calcasieu River	6.324	NO	YES	NO
	Reference Areas	25.772	NO	NA	YES
Piscivorus Birds					
DDT and Metabolites	Upper Calcasieu River	1.29	YES	NA	ID
	Bayou d'Inde	1.29	YES	NA	ID
	Middle Calcasieu River	1.29	YES	NA	ID
	Reference Areas	1.29	YES	NA	ID
Mercury	Upper Calcasieu River	6.13	NO	NO	YES
	Bayou d'Inde	28.4	NO	NO	YES
	Middle Calcasieu River	6.53	NO	NO	YES
	Reference Areas	2.59	NO	NA	YES
Selenium	Upper Calcasieu River	0.839	NO	NO	NO
	Bayou d'Inde	1.22	NO	NO	YES
	Middle Calcasieu River	0.924	NO	NO	NO
	Reference Areas	0.605	NO	NA	YES
2,3,7,8-TCDD-TEQs	Upper Calcasieu River	0.278	NO	YES	NO
	Bayou d'Inde	1.73	NO	NO	YES
	Middle Calcasieu River	1.51	NO	NO	YES
	Reference Areas	0.752	NO	NA	YES

Table G-15. Review and summary of risk quotient evaluations for all COPCs in all study areas.

Guild and Chemical of Potential Concern	Area	Hazard Quotient RQ	> 90% Non-Detects YES/NO	< 1.2x Reference Area YES/NO	Move to PRA YES/NO
Piscivorus Birds (cont.)					
Total PCBs	Upper Calcasieu River	0.038	NO	YES	NO
	Bayou d'Inde	1.03	NO	NO	YES
	Middle Calcasieu River	0.142	NO	YES	NO
	Reference Areas	0.58	NO	NA	YES
Piscivorus Mammals					
Aldrin	Upper Calcasieu River	0.279	YES	NA	ID
	Bayou d'Inde	1.26	YES	NA	ID
	Middle Calcasieu River	0.279	YES	NA	ID
	Reference Areas	0.239	YES	NA	ID
DDT and Metabolites	Upper Calcasieu River	0.853	YES	NA	ID
	Bayou d'Inde	1.34	YES	NA	ID
	Middle Calcasieu River	0.911	YES	NA	ID
	Reference Areas	0.698	YES	NA	ID
Dieldrin	Upper Calcasieu River	1.69	YES	NA	ID
	Bayou d'Inde	2.40	YES	NA	ID
	Middle Calcasieu River	1.97	YES	NA	ID
	Reference Areas	1.69	YES	NA	ID
Hexachlorobenzene	Upper Calcasieu River	6.28	NO	YES	NO
	Bayou d'Inde	9.35	NO	YES	NO
	Middle Calcasieu River	9.80	NO	YES	NO
	Reference Areas	10.5	NO	NA	NO

Table G-15. Review and summary of risk quotient evaluations for all COPCs in all study areas.

Guild and Chemical of Potential Concern	Area	Hazard Quotient RQ	> 90% Non-Detects YES/NO	< 1.2x Reference Area YES/NO	Move to PRA YES/NO
Piscivorus Mammals (cont.)					
Hexachlorobutadiene	Upper Calcasieu River	3.14	NO	YES	NO
	Bayou d'Inde	2.76	NO	YES	NO
	Middle Calcasieu River	3.88	NO	YES	NO
	Reference Areas	3.80	NO	NA	NO
Mercury	Upper Calcasieu River	3.29	NO	NO	YES
	Bayou d'Inde	12.2	NO	NO	YES
	Middle Calcasieu River	3.93	NO	NO	YES
	Reference Areas	2.33	NO	NA	YES
Selenium	Upper Calcasieu River	1.94	NO	YES	NO
	Bayou d'Inde	2.20	NO	NO	YES
	Middle Calcasieu River	2.50	NO	NO	YES
	Reference Areas	1.84	NO	NA	YES
2,3,7,8-TCDD-TEQs	Upper Calcasieu River	7.48	NO	NO	YES
	Bayou d'Inde	22.7	NO	NO	YES
	Middle Calcasieu River	10.8	NO	NO	YES
	Reference Areas	1.67	NO	NA	YES
Total PCBs	Upper Calcasieu River	45.9	NO	YES	NO
	Bayou d'Inde	125	NO	NO	YES
	Middle Calcasieu River	40.8	NO	YES	NO
	Reference Areas	49.8	NO	NA	YES

NC = Not calculated; NA = Not applicable; ID = Indeterminate; PRA = probabilistic risk assessment.

Table G-16. Contaminants of concern and areas of concern screening through to the probabilistic risk assessment (PRA).

Guild and Contaminant of Concern	Area[1]		
	UCR AOC	BI AOC	MCR AOC
Sediment-Probing Birds			
Lead	YES	YES	YES
Mercury	YES	YES	YES
Selenium	YES	YES	YES
2,3,7,8-TCDD TEQs	YES	YES	NO
Total PCBs	NO	NO	NO
Carnivorous-Wading Birds			
Lead	NO	NO	NO
Mercury	YES	YES	YES
Selenium	NO	NO	NO
2,3,7,8-TCDD TEQs	NO	YES	NO
Total PCBs	NO	NO	NO
Piscivorus Birds			
Lead	NO	NO	NO
Mercury	YES	YES	YES
Selenium	NO	YES	NO
2,3,7,8-TCDD TEQs	NO	YES	YES
Total PCBs	NO	YES	NO
Piscivorus Mammals			
Lead	NO	NO	NO
Mercury	YES	YES	YES
Selenium	NO	YES	YES
2,3,7,8-TCDD TEQs	YES	YES	YES
Total PCBs	NO	YES	NO
Omnivorous Mammals			
Lead	NO	NO	NO
Mercury	NO	YES	NO
Selenium	YES	YES	YES
2,3,7,8-TCDD TEQs	NO	YES	YES
Total PCBs	NO	NO	NO
Carnivorous Fish			
Lead	NO	NO	NO
Mercury	NO	NO	NO
Selenium	NO	NO	NO
2,3,7,8-TCDD TEQs	NO	NO	NO
Total PCBs	YES	YES	YES

[1] Calcasieu Estuary Reference Areas are included for all guilds and all COCs for comparison purposes.
UCR AOC - Upper Calcasieu River AOC; BI AOC - Bayou D'Inde AOC; MCR AOC- Middle Calcasieu River AOC

Figures

Figure G-1. Annual geometric mean concentration of Aroclor 1254 in fish fillet from the Upper Calcasieu River AOC (bars represent minimum and maximum concentrations).
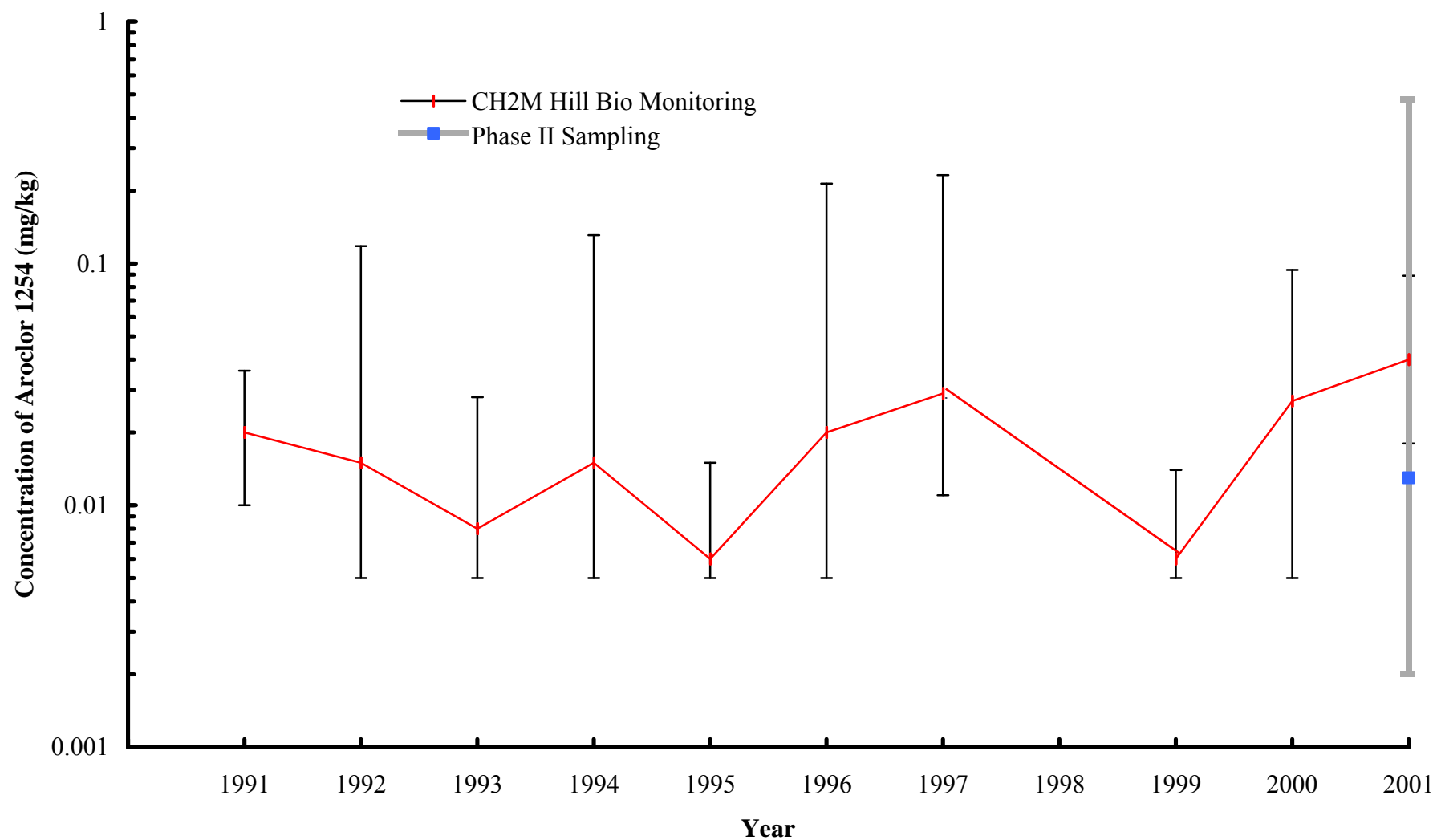
Figure G-2. Annual geometric mean concentration of Aroclor 1254 in fish fillet from the Bayou d'Inde AOC (bars represent minimum and maximum concentrations).
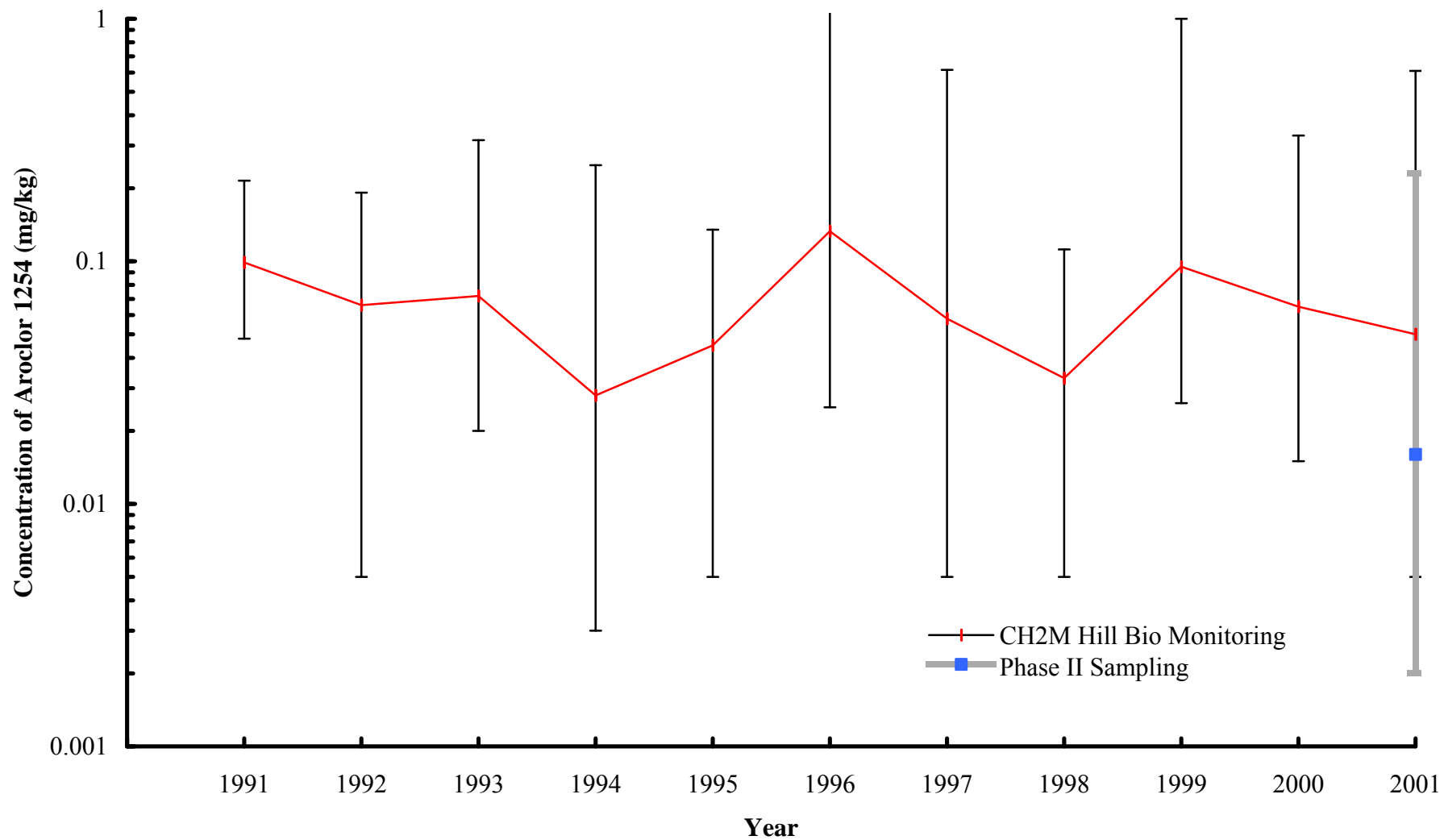
Figure G-3. Annual geometric mean concentration of Aroclor 1254 in fish fillet from the Middle Calcasieu River AOC (bars represent minimum and maximum concentrations).
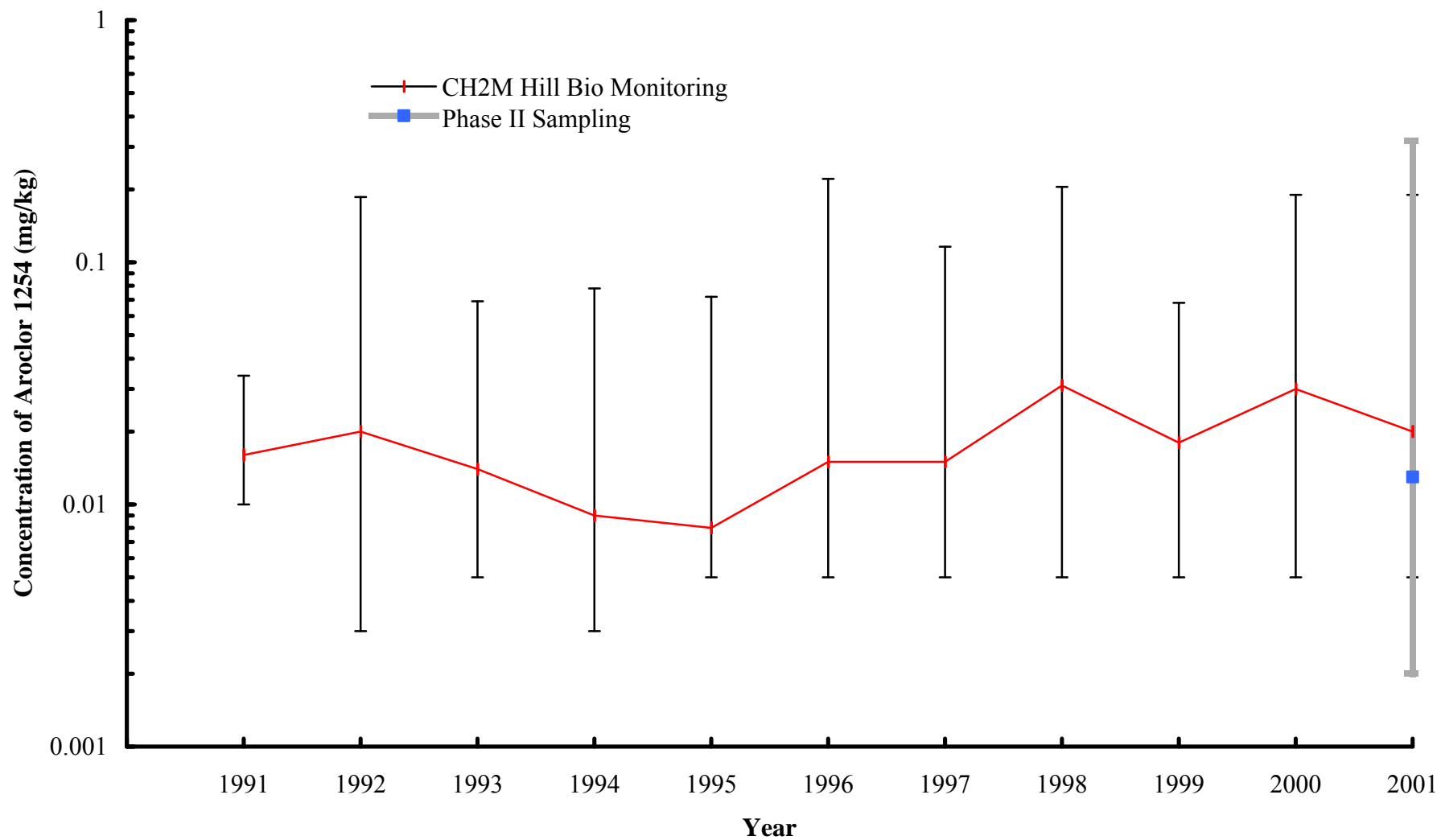
Figure G-4. Annual geometric mean concentration of Aroclor 1254 in fish fillet from the Reference Areas (bars represent minimum and maximum concentrations).